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HYDRO-ELECTRIC INQUIRY COMMISSION

ENGINEERING DATA


ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

STUDY OF MUSKOKA SYSTEM

WALTER J. FRANCIS & COMPANY

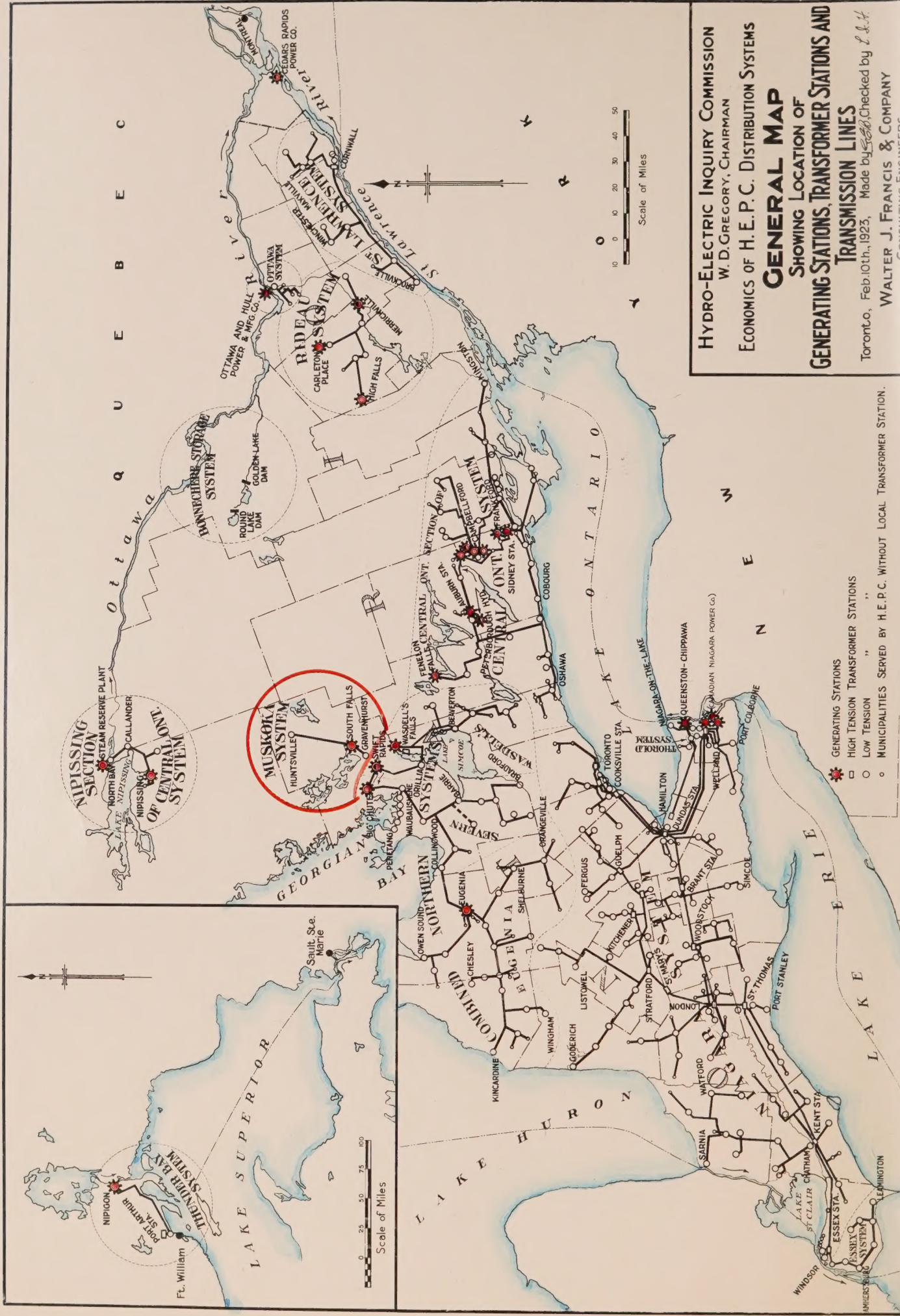
CONSULTING ENGINEERS

MUSKOKA SYSTEM



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HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN
ECONOMICS OF H.E.P.C. DISTRIBUTION SYSTEMS
GENERAL MAP
SHOWING LOCATION OF
GENERATING STATIONS, TRANSFORMER STATIONS AND
TRANSMISSION LINES
Toronto, Feb. 10th, 1923, Made by *W.D.G.* Checked by *P.L.H.*
WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

- GENERATING STATIONS
- HIGH TENSION TRANSFORMER STATIONS
- LOW TENSION
- MUNICIPALITIES SERVED BY H.E.P.C. WITHOUT LOCAL TRANSFORMER STATION

To face frontispiece.

General Map Showing Location of
Generating Stations, Transformer Stations and Transmission Lines
of the
Hydro-Electric Power Commission of Ontario.
and District
Local Distribution System

C O P Y

Description of Market
 Population Served and Percentage of Consumers to Population
 Growth of Market and Ultimate Sources of Power Supply

The area outlined in red shows the
Muskoka System.

Power Data
 Developed Horse-power
 Average Horse-power Generated
 Filled Horse-power
 Maximum Yearly Peak

Capital Costs per Horse-power Developed
Total Annual Revenue
Operating Costs
 Maintenance
 Overhead and General Expenses
 Interest, Sinking Fund and Contingencies
 Percentage Cost of Power

WILLIAM J. BROWN & COMPANY
100 N. 1st St. St. Louis, Mo.
Phone 1234

General and Special Agents of
Investigation, Chicago, Illinois, and
at the
Special Agents of the Bureau of Investigation

COPY



The above is a true and correct
copy of the original

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[illegible]

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Toronto, Ontario,

April 14th, 1923.

Hydro-Electric Inquiry Commission,

W. D. Gregory, Esq., Chairman,

T O R O N T O, Ontario.

re studies of Engineering Economics of the
Muskoka System of the
Hydro-Electric Power Commission of Ontario

Mr. Chairman and Gentlemen,-

In accordance with the letter to your Commission under date of November 4th, 1922, and your confirmation of the general instructions under date of November 15th, 1922, a study has been made of the engineering economics of the Muskoka System of electrical generation and distribution operated by the Hydro-Electric Power Commission of Ontario. The work has been done under the direct personal supervision of Mr. Frederick B. Brown, M.Sc., M.E.I.C., a partner in the firm of Walter J. Francis & Company, in accordance with your instructions.

The subject has been discussed with Mr. Commissioner M. A. Ross in detail, and, generally, with Mr. Bower, the Secretary of your Commission, and constant communication has been maintained with the officials of the Hydro-Electric Power Commission of Ontario.

The reports of Messrs. Price, Waterhouse & Co. have been used as the basis of the financial figures given herein, and reference has been made to the records of the Hydro-Electric Power Commission of Ontario where it was necessary to do so to prepare the diagrams.

TO: [illegible]
FROM: [illegible]

DATE: 10/10/77
SUBJECT: [illegible]

MEMORANDUM FOR THE DIRECTOR
OF THE CENTRAL INTELLIGENCE AGENCY
RE: [illegible]

1. [illegible]

2. [illegible]

3. [illegible]

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18. [illegible]

COPY

It is understood that it is not within the scope of the instructions to examine into any of the legal aspects of the system, nor discuss any of the Acts of the Legislature relating to it.

The necessary technical data has required considerable preparation, as much of it is only available in the operating records of the Hydro-Electric Power Commission of Ontario. The printed reports contain a part, but these have had to be supplemented by interviews with various officials, and by searching the voluminous records both at the head office in Toronto and elsewhere.

The general plan under which the report of the studies is presented may be outlined as follows:

- (1) A short review of the history and evolution of the system.
- (2) A brief physical description of the system.
- (3) A brief discussion regarding the characteristics of the local market.
- (4) A discussion of progressive capital costs.
- (5) Statistics regarding progressive revenues for various classes of service, with discussion thereon.
- (6) Statistics regarding progressive operating costs and fixed charges, with discussion thereon.
- (7) Statistics showing progressive and accumulated deficits or surpluses, with discussion thereon.
- (8) Analysis of progressive operating records and of unit revenues per kilowatt-hour and per horse-power per annum and of unit costs per kilowatt-hour and per horse-power per annum.

It is suggested that it is not within the scope of the investigation to make any of the local reports of the system, but that the local reports of the legislature relating to it. The necessary information for the investigation is to be obtained from the records of the State Department. It is suggested that the investigation be conducted in a systematic manner, and that the results be reported to the legislature. The investigation should be conducted in a systematic manner, and the results should be reported to the legislature. The investigation should be conducted in a systematic manner, and the results should be reported to the legislature.

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- (1) A brief physical description of the system.
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- (5) Statistics regarding progressive operating costs and fixed charges, with discussion thereon.
- (6) Analysis of progressive operating records and of unit revenues, with discussion thereon.
- (7) A comparison of the results of the investigation with the results of the investigation conducted by the legislature.

The report included herewith as pages 4 to 53 inclusive refers in detail to that portion of the activities of the Hydro-Electric Power Commission known as the Muskoka System. References are made to the possible inter-connection of this System with other systems.

Throughout the report diagrams have been included in the order of the text, while the map included as a frontispiece shows the System generally and its geographical relation to all the other systems operated by the Hydro-Electric Power Commission of Ontario.

COPY

Reference is made to the MUSKOKA SYSTEM July 10th, 1915, made by the

Commissioner of the Municipality of Gravenhurst provided for the

Frederick B. Brown, E. Sc.

and also from the Municipalities of the Town of Huntsville and the

Municipality of Gravenhurst. The purpose of the present

is to Evolution and Development of the System.

During the year 1909 the Hydro-Electric Power Commission of Ontario
first investigated power conditions in the district now comprising the

Muskoka System, with a view to supplying electrical energy to the Town of
Huntsville. The results of this investigation are contained in a report

to the Municipality of Huntsville under date of September 13th, 1909. A

further report on the power possibilities in this district was made by the

Commission on September 1st, 1911. In this, special reference was made to

the possible development of the power site at High Falls on the North

Branch of the Muskoka River.

The first step in the development of the Muskoka System was a contract

between the Commission and the Municipality of Huntsville, dated March 10th,

1915. On October 28th, 1915, another contract was drawn up with the Muni-

city of Gravenhurst to supply their power requirements, and during the same

month the hydro-electric power development at South Falls on the South Branch

of the Muskoka River was taken over by the Commission from the Municipality

of Gravenhurst, together with all land and water rights, and debenture liabi-

lities as outlined on page 3 of the "Report on Investigation of Accounts of

Muskoka System" and in further detail in Exhibit XII entitled "Memorandum

Wm. H. Brown, Jr. 18.

[illegible]

the possible development of the power site at High Falls on the North
branch of the Mokoko River.

The first step in the development of the Bureau's system was the creation of a system of classification of information. This was done in 1910, when the Bureau was reorganized. The system was based on the principle of "classification by subject matter." This system was the basis for the development of the Bureau's system of classification of information. The system was based on the principle of "classification by subject matter." This system was the basis for the development of the Bureau's system of classification of information.

Relative to Bonds and Debentures", dated July 26th, 1922, both by Messrs. Price, Waterhouse & Co. The Municipality of Gravenhurst retained the transmission line from the generating station to the town, together with the distributing station and system in Gravenhurst. The purchase of the properties at South Falls was authorized by an Order-in-Council dated November 10th, 1915.

The engineers of the Commission, in a report dated June 28th, 1915, gave the results of a valuation of all of the properties included in the Gravenhurst Power System. The following excerpt shows these properties divided into four main groups for which the replacement value and the present value had been estimated. The first of these items only, namely, the generating plant, was purchased by the Commission.

Items	Replacement Cost	Present Value
	as at June 28th, 1915	
Generation	\$52,158	\$39,386
Transmission	10,120	4,048
Transformation	13,050	10,362
Distribution	15,366	6,734
Totals	\$90,694	\$62,530

In this report it was suggested that the sum of \$43,386.61 be paid to the Municipality of Gravenhurst for the purchase of the generating plant which, it was estimated, had a value at that time of \$39,386, and would cost \$52,158 to replace. The actual price paid, however, was \$50,596. A revaluation of the properties was again made, following the purchase of

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the development, and an amount of \$33,230.00 was put down as tangible values, the difference of \$17,366.00 being entered in the books of the Commission as intangibles.

The Muskoka System commenced operations on November 1st, 1915, by operating the purchased generating station at South Falls. This had at that time an installed capacity of about 480 horse-power, about 250 of which was supplied to the Municipality of Gravenhurst over its transmission line, 8.8 miles in length, at the generator voltage of 6,600 volts.

Plans were immediately put under way to increase the capacity of the plant to meet the demands on the system, and to provide for the future requirements.

COPY

On August 25th, 1916, the new equipment was put into service, making available an additional 800 electrical horse-power.

The transmission line from Huntsville to South Falls, a distance of about 26 miles, was completed and tested on August 15th, 1916, and on August 25th Huntsville received its supply of power from the Muskoka system at 22,000 volts.

The distributing station at Huntsville was equipped by the Canadian General Electric Company who supplied three 300-K.V.A., single-phase, 60-cycle, 22,000-volt, to 2300/575-volt transformers, together with other necessary electrical equipment. Temporary connections were made to the high voltage transmission line pending the completion of this substation installation, which was finished in January of 1917. During July of the same year a 75-K.W. generator was purchased for the Municipality of Huntsville

and installed in the town's small generating station as a standby.

The original generating station of the South Falls development operated uninterruptedly throughout the whole period of construction of the extensions to the plant, between September, 1915, and September, 1916, and the Municipality of Gravenhurst was continually supplied with its power requirements.

On completion of the new unit, the old one was shut down and overhauled. The penstock was emptied and concrete saddles were placed under it, and the whole of the work was then painted. The armature of the old generator was rewound during 1917, and the machine readjusted and put into condition. A gate-house was erected during the same year.

The demand from Gravenhurst and Huntsville for power continued to increase steadily until in the year 1920 the full capacity of the South Falls generating station was reached. A further investigation of the undeveloped power possibilities and ultimate capacity of the South Falls site was made in that year. Towards the end of 1920, however, the demand for power from the Municipality of Huntsville decreased, due to industrial difficulties of the Anglo-Canadian Leather Company, the largest individual consumer of electricity on the Muskoka System. The average load on the system decreased about 150 electrical horse-power in 1921, but an improvement is shown for 1922, with an average of 12 monthly, twenty-minute peaks of 1,340 electrical horse-power and a maximum yearly peak of 1,456 electrical horse-power.

The report of Mr. Walter J. Francis, C. E., entitled "Principal Characteristics of H. E. P. C. Plants", addressed to the Hydro-Electric Inquiry

and installed in the lower small generating station as a standby.

The existing generating station at the lower falls was decommissioned and the machinery was removed to the upper falls.

In the early 1920s, between 1922 and 1924, and the machinery was removed to the upper falls.

On completion of the new unit, the old one was shut down and over-

hauled. The machinery was moved to the upper falls and the old machinery was dismantled.

and the walls of the work were then painted. The structure of the old gener-

ator was removed in 1927, and the machine was dismantled and put into con-

dition. A new machine was installed in the same place.

The new machine was installed in the same place and power continued to

be generated. It is now in the same place as the old one.

The existing station was removed. The machinery was dismantled and the

structure was removed. The machinery was dismantled and the

structure was removed. The machinery was dismantled and the

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structure was removed. The machinery was dismantled and the

structure was removed. The machinery was dismantled and the

Commission, gives the installed generator capacity of the South Branch plant as 1,280 horse-power, at 80 per cent. power factor.

Description of the System.

General.

The Muskoka system lies north of the Severn and Wasdell's systems. It extends about thirty miles north and south, and includes within its boundaries part of the county of Muskoka. Parts of the counties of Parry Sound and Haliburton might be served from this system if necessary.

The map included as a frontispiece shows the whole of the transmission systems of the Hydro-Electric Power Commission, with the location of generating stations, high voltage transformer stations, high voltage transmission lines and low voltage transformer stations, clearly indicated, and shows the various systems in their relation to one another. The tinted portion of the map indicates the Muskoka system.

The map included as page 9, shows the Muskoka system on a larger scale than the frontispiece and also gives the names of the principal centres concerned. It also shows the Wasdell's, Severn and Eugenia systems, which are adjacent to the Muskoka system, and which at some time may be inter-connected with it.

Speaking broadly, the Muskoka system consists of a 1,280 horse-power hydro-electric generating plant on the South Branch of the Muskoka River at

HYDRO-ELECTRIC POWER COMMISSION
W.D. GREGG, CHAIRMAN
ECONOMICS OF H.E.P.C. DISTRIBUTION SYSTEMS
EUGENIA, SEVERN, WASDELL'S SYSTEMS
AND MUSKOKA SYSTEM
MAP SHOWING LOCATION OF
GENERATING STATIONS, TRANSFORMER STATIONS
AND TRANSMISSION LINES
TRANS. ISOL. LINES
1 inch to 10 miles
WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS
Toronto, April 14th, 1911. 1,280 horse-power checked by Mr. J. Allan Ross.

...the installed generator capacity of the South Falls plant
at 1,200 horsepower, at 80 per cent. power factor.

INSTALLATION OF THE SYSTEM

...

The system was first installed on the town and Randall's system. It
...part of the city of New York. ...
...COPY...
...necessary.

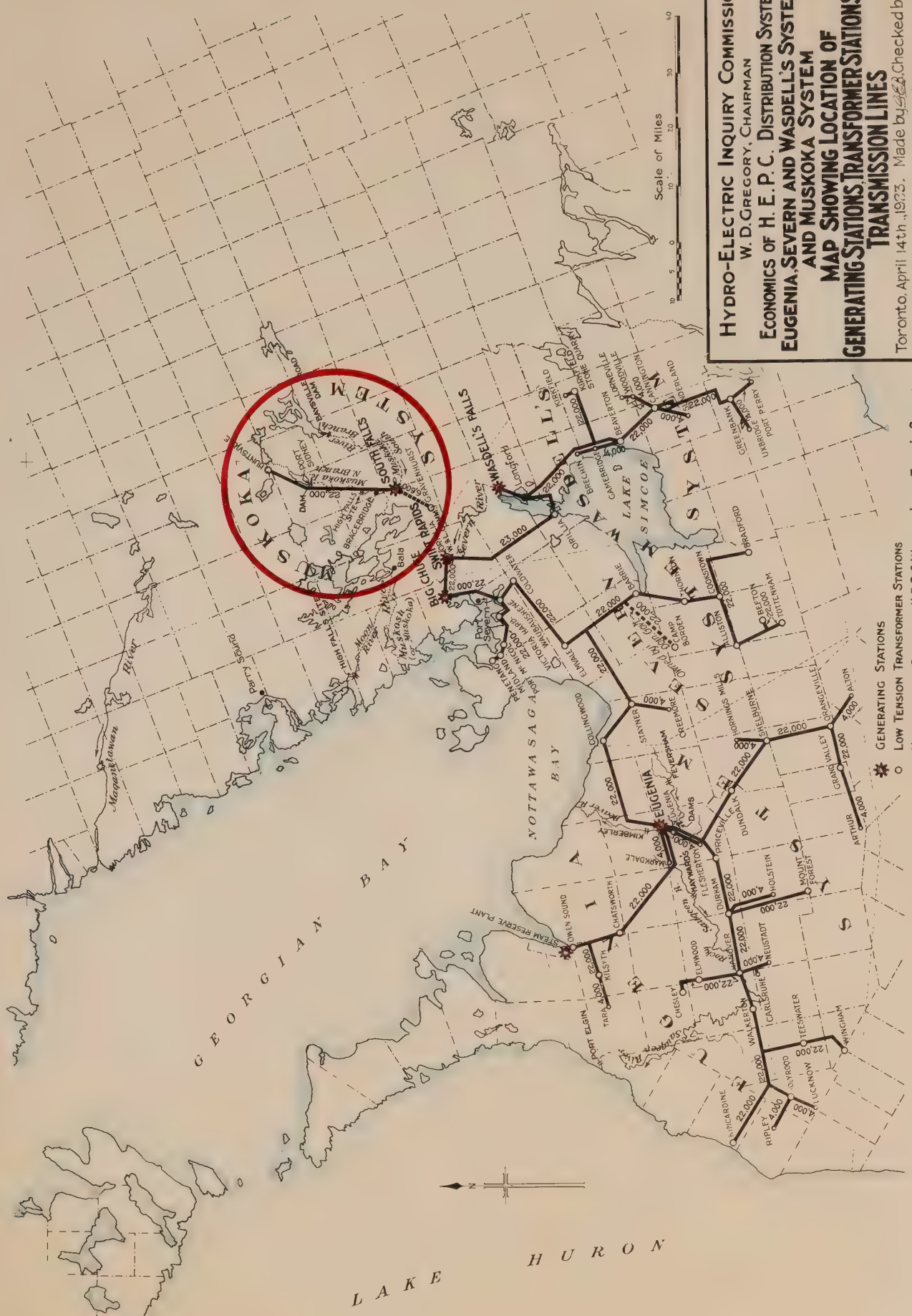
The system is a ...
...systems of the Hydro-Electric Power Commission, with the location of generat-
...the system, ...
...map indicated the ...

The map included as page 2, shows the ...
...also shows the ...
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HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN
ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS,
EUGENIA, SEVERN AND WASDELL'S SYSTEMS,
AND MUSKOKA SYSTEM
MAP SHOWING LOCATION OF
GENERATING STATIONS, TRANSFORMER STATIONS AND
TRANSMISSION LINES

Toronto, April 14th, 1923. Made by *W.D.G.* Checked by *W.D.G.*
WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS



South Falls, together with transmission lines and distributing stations feeding two municipalities.

Generating Station and Other Sources of Power Supply.

(a) South Falls Plant.

The South Falls plant is the only generating station on the Muskoka System at present owned by the Hydro-Electric Power Commission of Ontario.

This development is located on the South Branch of the Muskoka River, at Muskoka Village, three miles to the south of Bracebridge and about seven miles north of Gravenhurst. The first stage of the development was completed in 1906, and consisted of a concrete dam twenty feet high by eighty feet long, from which the water was led to a power house through a steel penstock three feet in diameter and about 1,000 feet long. The generating equipment contained in the power house was one 700 horse-power turbine utilizing a head of about 105 feet, directly connected to a 450-K.V.A., three-phase, 60-cycle, 6,600-volt generator, manufactured by the Allis-Chalmers Sullock Company, supplying electricity to Gravenhurst at the same voltage.

During September of 1915 plans were commenced to increase the capacity of this plant and to provide for the future extension of the development. This work consisted of remodelling the forebay, installing a wood-stave pipe line and a short length of steel penstock, the extension of the power house and the tail-race, and the addition of the mechanical and electrical equipment required.

Because of the nature of the work and because the old plant had to be

with total agreement with Commission lines and distributing decisions
without any modification.

[Faint, illegible text]

1. The first thing I noticed when I stepped out of the plane was the cold, crisp air. It felt like a blanket after a long, hot journey. The ground below was a patchwork of green fields and small villages, stretching out as far as the eye could see. The sun was just beginning to set, casting a warm, golden glow over the entire landscape. I took a deep breath, savoring the fresh air and the beauty of the new world I had just arrived in.

COPY

supplying electricity to the plant and to the town of
Lima. The plant was designed to produce 100,000
kilowatts of power and to provide for the future extension of the development.
The plant was designed to produce 100,000 kilowatts of power and to provide for the future extension of the development.
The plant was designed to produce 100,000 kilowatts of power and to provide for the future extension of the development.
The plant was designed to produce 100,000 kilowatts of power and to provide for the future extension of the development.

kept in service during the extensions, the engineers state that only the superstructure could reasonably be let by contract, and that it was impossible to obtain economical tenders for the other work. The construction was therefore undertaken by the Commission under force account, except for the power house superstructure, which was let to Messrs. Witchall & Sons, Toronto.

It was also found necessary to raise the level of a stretch of highway upstream from the dam in order that the water might be raised to its maximum economical head.

The changes and additions to the substructure were completed on March 27th, 1916, and Messrs. Witchall & Sons of Toronto on May 27th, 1916, completed their contract for the superstructure work, which included the construction of a concrete floor and roof in the old section of the power house. The Pacific Coast Pipe Company installed a wood-stave pipe line five feet in diameter and 970 feet long, connecting it to a 30-foot length of steel penstock, constructed and installed by the William Hamilton Company of Peterborough, which Company was also the contractor for one 1,060 horse-power, horizontal, single-runner, Francis type turbine, operating at 720 revolutions per minute. This turbine has a globe casing and fly wheel and is equipped with a butterfly valve. One 750-K.V.A., 3-phase, 60-cycle, 6,600-volt generator and one 20-kilowatt motor-driven exciter, together with transformers and other electrical apparatus were supplied and installed by the Canadian General Electric Company. The units of this plant operate at a minimum head of 102 feet and a mean net head of 108 feet. The mean gross head at the site is about 115 feet. Three 400-K.V.A. station transformers step up the voltage

from 6,600 to 22,000 volts for transmission to the distributing station at Huntsville. The power is transmitted to Cravenhurst at 6,600 volts, the generator voltage of the South Falls plant.

Data on Partly-developed Lower Site at South Falls

The drainage area of the South Branch of the Muskoka River above this

site is about 677 square miles and the developed water storage of the river

1. Name of River Muskoka - South Branch near
is about 1,050 million cubic feet. Local pondage at the plant is available

2. Drudage Area, Square Miles 677

for daily peak operation. See Table on Page 12

3. Mean Precipitation per Annum in Inches 32.2

4. The installed capacity of this plant at the present time is approximately

5. Mean Run-off per Annum, C.F.S. 725

1,260 electrical horse-power at 80% power factor in accordance with the ordin-

6. Mean Available Head, Feet 120

ary rating of the Hydro-Electric Power Commission of Ontario. It is stated,

10. Years of Use 5 - 175

However, that a maximum of 4,000 horse-power can be developed at this site

12. Water Storage, Million Cubic Feet 1,050

with the addition of the necessary generating equipment, for which it is

understood some provision has already been made during the period of alterations in the years 1915 and 1916.

11. High Falls on the North Branch of the Muskoka River, about eight miles north of the South Falls Plant, and about 21 miles from the town of Huntsville.

(b) Undeveloped Power Sites, Muskoka System.

There is an undeveloped hydro-electric power site stated to have a capacity

13. The partly developed South Falls power site on the South Branch of the Muskoka River has available the largest undeveloped power possibilities in the district included in the Muskoka System. Some details of this site are given in the table on the following page, the data being taken from the report entitled "Principal Characteristics of H.E.P.C. Plants", by Mr.

Walter J. Francis, C. E. There are 1,260 electrical horse-power developed at the present time, and it is stated that about 4,000 horse-power more can

1915

from 6,000 to 12,000 volts for transmission to the distributing station at Gravenhurst. The power is transmitted to Gravenhurst at 6,000 volts.

The generator voltage of the south falls plant.

The distance from the south falls plant to the distributing station at Gravenhurst is 12 miles. The power is transmitted at 6,000 volts. The generator voltage of the south falls plant is 1,200 volts. Local ponds at the plant are available for the use of the plant.

The electrical equipment of the plant is of the latest type. The generator is a 1,200 volt, 100 horsepower machine. The motor is a 1,200 volt, 100 horsepower machine. The transformer is a 1,200 volt, 100 horsepower machine. The switchgear is a 1,200 volt, 100 horsepower machine. The control system is a 1,200 volt, 100 horsepower machine. The entire plant is a 1,200 volt, 100 horsepower machine. It is stated, however, that a maximum of 1,200 horsepower can be developed at this site. The electrical equipment of the plant is of the latest type. The generator is a 1,200 volt, 100 horsepower machine. The motor is a 1,200 volt, 100 horsepower machine. The transformer is a 1,200 volt, 100 horsepower machine. The switchgear is a 1,200 volt, 100 horsepower machine. The control system is a 1,200 volt, 100 horsepower machine. The entire plant is a 1,200 volt, 100 horsepower machine. It is stated, however, that a maximum of 1,200 horsepower can be developed at this site. The electrical equipment of the plant is of the latest type. The generator is a 1,200 volt, 100 horsepower machine. The motor is a 1,200 volt, 100 horsepower machine. The transformer is a 1,200 volt, 100 horsepower machine. The switchgear is a 1,200 volt, 100 horsepower machine. The control system is a 1,200 volt, 100 horsepower machine. The entire plant is a 1,200 volt, 100 horsepower machine. It is stated, however, that a maximum of 1,200 horsepower can be developed at this site.

(1) The electrical equipment of the plant is of the latest type.

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be made available without the necessity of any additional structures, or the further purchase of properties:

cost of \$114 per horse-power developed for 1912 conditions. The present
 of this site.

Data on Partly-developed Power Site at South Falls

This generating station at Huntsville would permit of the parallel operation

1. Name of River	Muskoka - South Branch near Muskoka Village
2. Drainage Area, Square Miles	677
3. Minimum Precipitation per Annum in Inches	35.0
4. Mean Precipitation per Annum in Inches	41.5
5. Minimum Monthly Run-off, C.F.S.	203
6. Mean Run-off per Annum, C.F.S.	985
7. Minimum Available Head, Feet	102
8. Mean Available Head, Feet	115
9. Years of Precipitation Records	1877 - 1920
10. Years of Gauging Records	1915 - 1920
11. Water Horse-power, Mean	12,100
12. Water Storage, Million Cubic Feet	1,050

At High Falls on the North Branch of the Muskoka River, about eight miles north of the South Falls Plant, and about 21 miles from the Town of Huntsville, there is an undeveloped hydro-electric power site stated to have a capacity of about 1,300 water horse-power obtainable at a head of 44 feet. A dam at this point would improve the low water conditions of the hydro-electric plants owned by the Municipality of Bracebridge, and located farther downstream on the same river. It was stated by the Commission in a report dated September 1st, 1911, that a generating plant of 1,200 horse-power installed capacity could be built at High Falls for about \$65,000, with transformer equipment at both High Falls and Huntsville to cost \$19,600.

the further purchase of property;

[illegible]

12.	Water Storage, Million Gals Per	1,080
11.	Water Horse-power, Horse	12,100
10.	Cost of Water Power	1916 - 1920
9.	Cost of Fuel Oil per Year	1917 - 1920
8.	Mean Available Head, Feet	116
7.	Minimum Available Head, Feet	108
6.	Mean Run-off per Annum, C.F.S.	986
5.	Minimum Monthly Run-off, C.F.S.	208
4.	Mean Evaporation per Annum in Inches	41.8
3.	Drainage Area, Square Miles	977
2.	Length of Projected Dam in Feet	72.0
1.	Name of Engineer	Inventor - JAMES HENRY JOSEPH Inventress - MARY JOSEPH

1. The first thing I noticed when I stepped out of the plane was the cold. It was a sharp contrast to the warm, humid air of the tropics. I had heard that the weather in the mountains was unpredictable, but I didn't realize it would be so different. The air was crisp and clear, and the sun was shining brightly. I had heard that the weather in the mountains was unpredictable, but I didn't realize it would be so different. The air was crisp and clear, and the sun was shining brightly.

and 21 miles of transmission lines about \$51,600. The whole development was estimated to cost approximately \$186,200, or equivalent to a capital cost of \$114 per horse-power developed for 1911 conditions. The proximity of this site to the existing high voltage transmission line from the South Falls generating station to Huntsville would permit of the parallel operation of the South Falls plant and a plant at High Falls with the construction of only about one mile of additional transmission line. The elimination of this item, together with the cost of transformers at Huntsville, would be equivalent to about \$70,000. This would leave only the plant and a mile or so of line to be built, and allowing for increased costs since 1911 the development might possibly prove economically feasible on further investigation.

On the Muskoka River, at the outlet of Lake Muskoka and about 10 miles from Georgian Bay, are located two falls known as Moon Chute, 10 feet head, and Bala Falls, 20 feet head. Reports to the Commission of Conservation of reconnaissance surveys made some years ago indicate that these two falls might be developed together to give about 2,300 water horse-power at a minimum of 30 feet head. A development at this site would probably control the level of the Muskoka Lakes making available a very large pondage above the dams, but it is doubtful whether this could be utilized as a commercial peak load plant due to the fact that fluctuations of the water level would be injurious to the use of these lakes as summer resorts, which purpose they serve extensively at the present time.

About five miles farther downstream on the same river, commences a series of four falls known respectively as First and Second Falls, 20 feet head; Third Fall, 12 feet head; Fourth Fall, 30 feet head; and Eighth Fall, 34 feet

and is also in the same line about \$21,800. The whole development
was estimated to cost approximately \$22,500, or equivalent to a capital
cost of \$11 per horsepower developed for 1911 conditions. The possibility
of this site to the existing line within the same line from the north
this estimated station as compared with the present station
of the river this plan and a line as this plan with the development of
only about one mile of additional transmission line. The elimination of
this line, together with the cost of transmission of electricity, would be
equivalent to about \$1,000. This would leave only the cost of a mile of
to be paid to the public, and allowing for interest costs since this line
development, about \$1,000. This would leave only the cost of a mile of
to the public, and allowing for interest costs since this line
from the public, and allowing for interest costs since this line
and this plan. The cost of the transmission of electricity at
proposed station would be about \$1,000, and this plan would be about \$1,000
to be developed together to give about \$1,000, and this plan would be about \$1,000
to be developed. A development at this site would probably result in the
of the same later station would be a very large package above the dam.
but it is difficult to see how this could be utilized as a commercial power line
than in the past the transmission of the water level would be reduced
to the site of the dam. The cost of the dam would be about \$1,000, and
tentatively at the present time.

About the same further development of the same river, however a station
at this site would probably be about \$1,000, and this plan would be about \$1,000
than this, in the same line, and this plan would be about \$1,000, and this plan

head. These four falls aggregate about 96 feet total head, and a development at this site would have the benefit of the Lake Muskoka storage. A plant of a few thousand horse-power might possibly be installed at this site if the local construction conditions prove feasible and economical, upon further investigation.

There are also two possible power sites on the Moon River which also drains Lake Muskoka a short distance north of the Muskoka River. These are as follows: A series of five rapids is located about 15 miles from the source of this river, and are known as Curtain Chutes, Seven Sisters Rapid, Knife Rapid, Annie Rooney Rapid and Island Portage, and have a total head of 56 feet, and a combined capacity of about 2,000 or 3,000 horse-power. About five miles downstream from this site, near the mouth of the Moon River where it empties into Georgian Bay, there are two falls within a short distance of each other, known as High Falls and Twin Falls. These have a combined head of 60 feet and it is stated that a development at this site would also have available about 2,000 or 3,000 horse-power. Very little information of value is available for these sites.

Miscellaneous Power Plants in the District.

The following table gives the location, size and ownership of the various plants in the district of the Muskoka System:

... upon further investigation.

... the ...

... in the ...

The following ...

Miscellaneous Power Plants in the District of Muskoka System

Location	Kind of Power	Approximate H.P.	River	Owner and Remarks
Bracebridge No.1	Water	215	Muskoka River S.Branch	Municipal Waterworks
Bracebridge No.2	Water	6800	Muskoka River N.Branch	Municipal, Power and Light
Bracebridge No.3	Water	6900	Muskoka River N.Branch	Municipal, Power and Light
Ufford	Water	60	Bogart Creek	Supplies Lumber Mill
Sala	Water	320	Muskoka River	Lighting Load etc.

6 Operate at 60 cycles and 2,200 volts.

It is stated that the hydro-electric plants owned by the Municipality of Bracebridge are now being operated to full capacity and that a request for estimates on the cost of additional power has been made to the Commission.

Transmission Lines.

Up to October 31st, 1911, the Hydro-Electric Power Commission of Ontario had constructed a total of 26.3 miles of high voltage transmission lines, supplying the Municipality of Huntsville at 12,000 volts from the South Falls generating station.

The transmission line to Traverhurst, 8.8 miles in length, delivers power to the town at 6,600 volts. This line was constructed by the municipality and is still owned by it. The transmission system is constructed on wooden poles throughout and presents no extraordinary features.

Transforming and Distributing Station.

The transmission line feeds the Municipality of Huntsville at low voltage through the substation located in that town. The capacity of the transformers is 900 K.V.A., stepping down the voltage from 22,000 to 2,300 volts, and to 575 volts.

The Municipality of Gravenhurst does not require a high voltage transforming station as it receives power at 6,600 volts, the voltage of the generators at the South Falls plant, and has its own municipal substation reducing the voltage to 2,200 volts for distribution in the municipality.

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Local Distributing Systems.

There are no municipalities on the Muskoka System in which the Hydro-Electric Power Commission of Ontario distributes retail power to the consumers. The Commission acts as a wholesale distributor only and in both of the municipalities the electricity is distributed by the municipality itself. It is understood that the accounting for both of the municipalities of the Muskoka System is done in accordance with the standard accounting system of the Hydro-Electric Power Commission of Ontario, and the details for the various municipalities are given in the Annual Report.

Characteristics of Market.

Population Served and Percentage of Consumers to Population.

The district served by the Muskoka System is urban only, there being

Investigation of the

The investigation was made by the Commission at the
request of the Commission. The Commission is
composed of the following members: The President of the
Commission, and the Vice President.

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Walter J. Ransom & Company

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Investigation of the

Investigation of the

The Commission is composed of the following members:

no rural lines built to October 31st, 1922. The whole of the load is carried by the Municipalities of Gravenhurst and Huntsville, which in turn sell large blocks of power under contract to the National Potash Corporation in Gravenhurst and the Anglo-Canadian Leather Company in Huntsville. During the summer season some electricity is sold to sundry customers at Muskoka Falls.

"Municipal Statistics" of the Province of Ontario for 1921 gives a total population of about 21,000, all-year residents, for those portions of the Counties of Muskoka, Parry Sound, and Haliburton, which might be tributary to the Muskoka System. At October 31st, 1921, the total population in the two municipalities served by the System was about 3,600 persons, with about 614 consumers. As Bracebridge with about 2,400 population, is the only other town of any size tributary to the Muskoka System and is already supplied with electricity by its own plants, the greater part of the remaining 15,000 population could only be supplied by a fairly extensive system of rural lines. The two municipalities now served were billed with about 1,207 horse-power in the fiscal year 1921, and about 1,344 horse-power in 1922, thus showing an increase of about 137 horse-power in the demands of Gravenhurst and Huntsville. The indications are that the Municipality of Bracebridge will require a fairly large amount in the near future to meet the industrial growth and municipal requirements, their present demand having already outgrown the capacity of their hydro-electric plants.

The table on the following page gives in detail the number of

consumers at the end of the fiscal year 1921, in the places served by the Commission, the approximate horse-power billed to each place in 1921, the total kilowatt-hours consumed on the system in 1921, together with the average horse-power and average kilowatt-hour per consumer. The figures are useful for comparison with other systems although they should be used with caution:

Table of Market Statistics

Municipality	Population	Consumers	Percentage Consumers to Population	H.P. Billed 1921	Kilowatt Hours 1921	Billed H.P. per Consumer	Kilowatt Hours per Consumer
Gravenhurst	1,432	281	25.6	368.2	-	0.97	-
Huntsville	2,176	434	19.9	839.0	-	1.93	-
Totals	3,608	815	22.6	1,207.2	4,605,325	1.48	5,650

The average horse-power billed per consumer and per capita, and the average kilowatt-hours per consumer and per capita for the fiscal year 1921 are as follows:

Average Horse-power Billed per Consumer	1.48
Average Horse-power Billed per Capita	0.33
Average Kilowatt-hours Billed per Consumer	5,650
Average Kilowatt-hours Billed per Capita	1,276

Growth of Market and Ultimate Sources of Power Supply.

Since the commencement of operations of the Muskoka System in November 1915, the growth has been steady except for a decrease of about 150 horse-power

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Table 2. ...

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during 1921, due to an industrial slump at Huntsville. The table given below shows the loads for the System, the figures being given in horse-power:

Table of Power Consumption by Municipalities

	Fiscal Years Ending October 31st.						
	1916	1917	1918	1919	1920	1921	1922
Gravenhurst	+235	+321.7	312.6	359.3	478.4	368.2	362.7
Huntsville	+580	+597.8	667.3	826.6	871.6	839.0	981
Totals	815	919.5	979.9	1,185.9	1,350.0	1,207.2	1,343.7

+ Power taken during October.

It will be seen from the table above that the load for Huntsville during 1922 has increased by about 140 horse-power over that of 1921, thus showing that industrial conditions are approaching normal and that the System has regained its usual growth. These figures do not show the actual peaks on the System, but they do indicate the growth of the demand.

The problem of serving rural customers is difficult, the average number of consumers per mile being small, and the experience of the Hydro-Electric Power Commission is that only three or four per mile are obtainable.

The situation at the present time is that there is a shortage of power at South Falls and at the Bracebridge plants. Indications are that the Municipality of Bracebridge will soon become a partner in the Muskoka System, and will either operate their plants in parallel with the South Falls generating station or will receive an additional supply of power from the transmission system.

111 - 112 - 113

... The table gives values
... given in horse-power:

Table of Power Consumption

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911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It is estimated by the engineers of the Commission that the 4,000 horse-power still said to be available at the South Falls plant when the necessary generating equipment will have been installed, will be taken up by 1928.

It will then be necessary to look to the High Falls site on the North Branch of the Muskoka River or to the other sites mentioned above, or to some source outside of the district of the Muskoka System. Except for the South Falls site, most of the individual sites in the district are comparatively small, but the aggregate capacity might be from 12,000 to 15,000 horse-power exclusive of South Falls, provided that all the sites prove to be commercially feasible for development. The value of the sites on the lower Muskoka River and on the Moon River would depend in large measure on the degree of practicable regulation of Lake Muskoka, which is doubtful.

This brings up the question of the ultimate use of power in the district and the future source of power supply. If Niagara power be used it would necessitate the building northwards of a number of tie lines extended from the Niagara System to the Wasdell's and Severn Systems and from there to the Muskoka System, and adapted for the Muskoka System by means of frequency-changers, since Niagara power is developed at 25 cycles, and the other Systems use 60 cycles.

To use power from the French River for the Muskoka System and for the Combined Northern Systems, and possibly for the Nipissing Section and for the northerly portion of the Trent Section of the Central Ontario System, long transmission lines from the French River to Nipissing, and from Nipissing to Muskoka, and from Muskoka to Wasdell's and to the Trent Systems would be required. As all of these Systems are operated at 60 cycles, the

[illegible]

use of French River power, which is contemplated at 60 cycles, would avoid the use of frequency-changing apparatus. The development of the French River sites would depend on the growth of the load on the Combined Northern Systems, and in the North Bay-to-Sudbury district, to a sufficient degree to permit of their economical use. If the general power demand continues to increase at a rapid rate, the total economical capacity of the French River sites, which is probably about 20,000 horse-power, might be reached within a comparatively few years, in which case Niagara power would be the only feasible source of supply. From an operating point of view it would be preferable to use power generated at 60 cycles and avoid the complication of frequency-changers. It is understood that the Hydro-Electric Power Commission contemplates the use of some Niagara power through frequency-changers in the near future, for the Eugenia System.

If power be transmitted from either of these sources, a system of billing for each of the four or five systems affected would have to be developed so as to fairly apportion the costs of the transmitted power.

Capital Costs.

General.

The figures of capital costs given in the following table, and plotted diagrammatically, and shown on the sheet of curves included as page 24, were obtained from the Annual Reports of the Hydro-Electric Power Commission. The

total capital expenditures as at October 31st, 1921, conform with those given on page 6 of the report on the accounts of the Muskoka System by Messrs. Price, Waterhouse & Co.

Table of Progressive Capital Costs

	Fiscal Years Ending October 31st,						
	1915	1916	1917	1918	1919	1920	1921
Power Development	\$ 5,310	\$78,707	\$127,106	\$134,336	\$139,190	\$148,018	\$148,321
Transmission Lines	28,230	52,626	54,217	54,313	54,313	54,313	54,313
Transforming and Distributing Stations	-	8,924	8,916	9,624	9,633	9,766	9,897
Totals	\$33,540	\$140,257	\$190,239	\$198,273	\$203,136	\$212,117	\$212,531

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The total capital cost for power development to the end of the fiscal year 1921, includes an amount of \$50,596, which was paid to the Municipality of Gravenhurst as the purchase price of the South Falls plant, in consideration of which the Hydro-Electric Power Commission of Ontario assumed debentures to that amount.

Following a revaluation of the physical properties involved, made by the engineers of the Hydro-Electric Power Commission, an amount of \$23,230 was entered in the books of the Commission as the total tangible value of the old generating plant. This left an amount of \$17,366 as the difference between the purchase price and the estimated value, which was entered in the books as intangibles, as reflected in Exhibit II of the Price, Waterhouse & Co. report on "Investigation of Accounts of Muskoka System". Since September, 1915, the Commission has expended \$97,726 for hydraulic construction, repairs, alterations, and the necessary generating equipment to increase the capacity

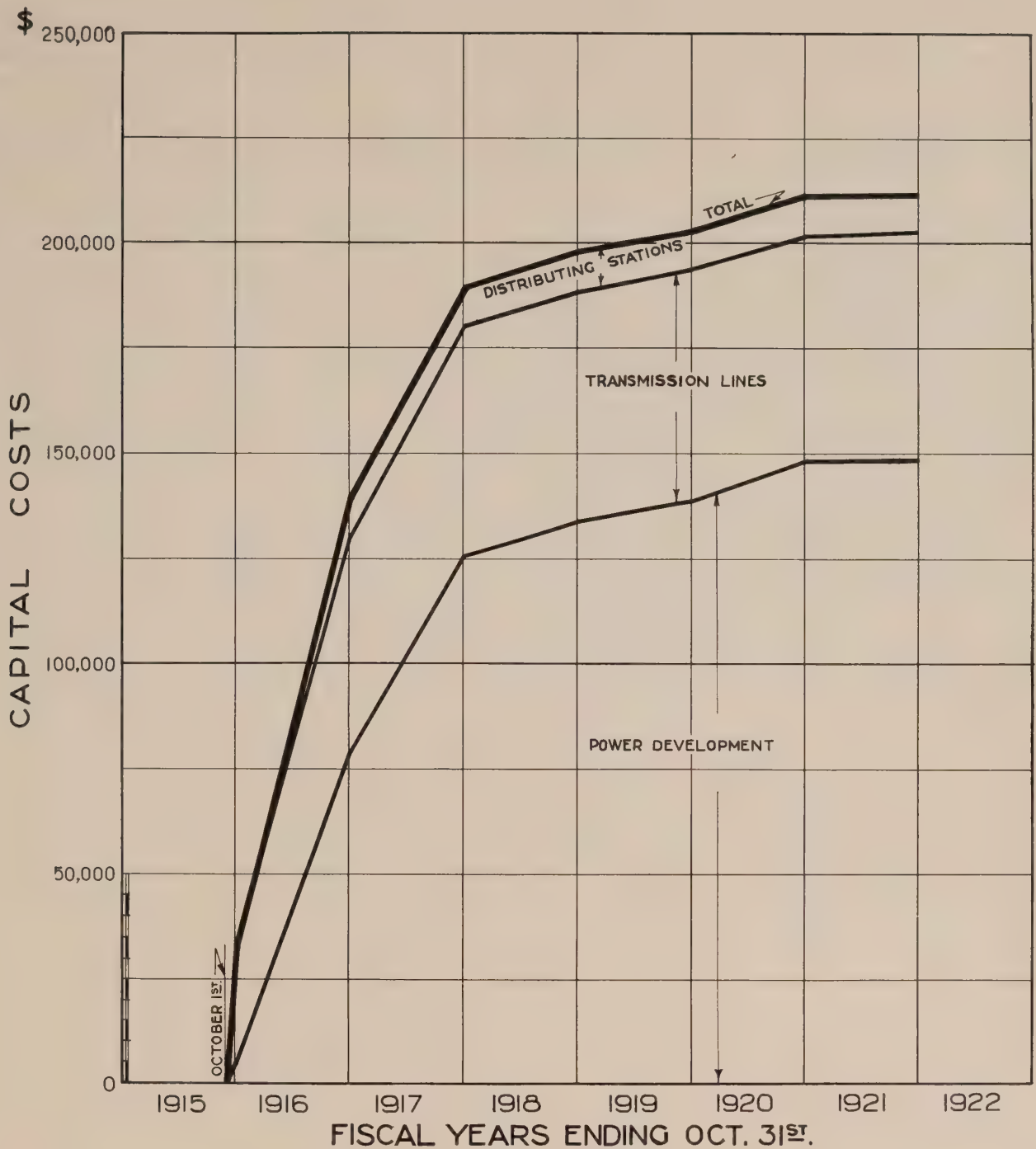
Reference is made to the letter of the 10th of January, 1944, from the Ministry of the Interior, No. 10000, and the letter of the 10th of January, 1944, from the Ministry of the Interior, No. 10000.

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The report of the Special Agent in Charge, New York, dated June 1, 1941, is being referred to the Bureau for information.



HYDRO-ELECTRIC INQUIRY COMMISSION
 W. D. GREGORY, CHAIRMAN
 ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS
MUSKOKA SYSTEM
PROGRESSIVE CAPITAL COSTS

Toronto, April 14th., 1923. Made by *WJF*, Checked by *WJF*

WALTER J. FRANCIS & COMPANY
 CONSULTING ENGINEERS

of the South Falls plant. The cost of the transmission lines from South Falls to Huntsville was \$52,700, and other transmission line costs were \$1,613, making a total of \$54,313 for transmission lines on the Muskoka System. The distributing station at Huntsville, together with the electrical equipment installed therein, amounted to \$9,897. The total of these figures amounts to \$212,581, which represents the total capital expenditures to October 31st, 1921.

The subdivision of the total actual capital costs of the South Falls plant is as follows: land and water rights, \$17,524; dams and water structures, \$52,933; power house, \$20,218; equipment, \$57,546; total, \$148,221. These figures include a total intangible value of \$17,366, as mentioned above, which cannot be readily separated from the various items.

It has been estimated that additional funds of \$5,000 will be required during 1922, and \$5,000 during 1923, in order to improve and extend lines and stations. The cost of the necessary equipment to increase the generating capacity of the South Falls plant has apparently not been included by the Commission in their estimated requirements for these years.

Power Data.

The following table and the diagram on page 27 have been prepared to show the characteristics of the Muskoka System in terms of horse-power:

of the ... The cost of the transmission lines from ...
to ... and ...
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It has been estimated that ...
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... mission in their estimated requirements for these years.

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Table of Horse-power Data

	Fiscal Years Ending October 31st,						
	1916	1917	1918	1919	1920	1921	1922
Developed	480	1,280	1,280	1,280	1,280	1,280	1,280
Consumed	-	-	-	-	-	704.7	811
Billed	-	-	979.9	1,185.9	1,350.0	1,207.2	1,343.7
Average of 12							
Monthly Peaks	-	-	-	1,133	1,317	1,172	1,340
Maximum Yearly							
Peak	815	-	-	1,525	1,570	1,315	1,456

It will be noted that there are five different classes of horse-power shown in the table and on the diagram. These may be explained as follows:

COPY

Developed Horse-power.

The figures for plotting the curve showing developed horse-power were obtained from the records of the Hydro-Electric Power Commission and are the sum of the capacities of the various units installed in the South Falls station, expressed in horse-power at 80 per cent. power factor according to the usual Hydro-Electric Power Commission rating.

Average Horse-power Consumed.

The average horse-power consumed has been derived from the total number of kilowatt-hours given by the Hydro-Electric Power Commission as being the total kilowatt-hours supplied to the Muskoka System for the years ending October 31st, 1921 and 1922. The derivation was made by dividing the total

MUSKOKA SYSTEM
HORSE-POWER DATA

Table 1. Hydroelectric Power

	1922	1923	1924	1925	1926	1927	1928
Developed	460	1,280	1,280	1,280	1,280	1,280	1,280
Undeveloped	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-
Installed	-	-	-	-	-	-	-
Capacity	-	-	-	-	-	-	-
Monthly Peak	-	-	-	-	-	-	-
Annual Peak	815	-	-	-	-	-	-

It will be noted that there are five hydroelectric plants in operation in the City of Los Angeles. These are the following:

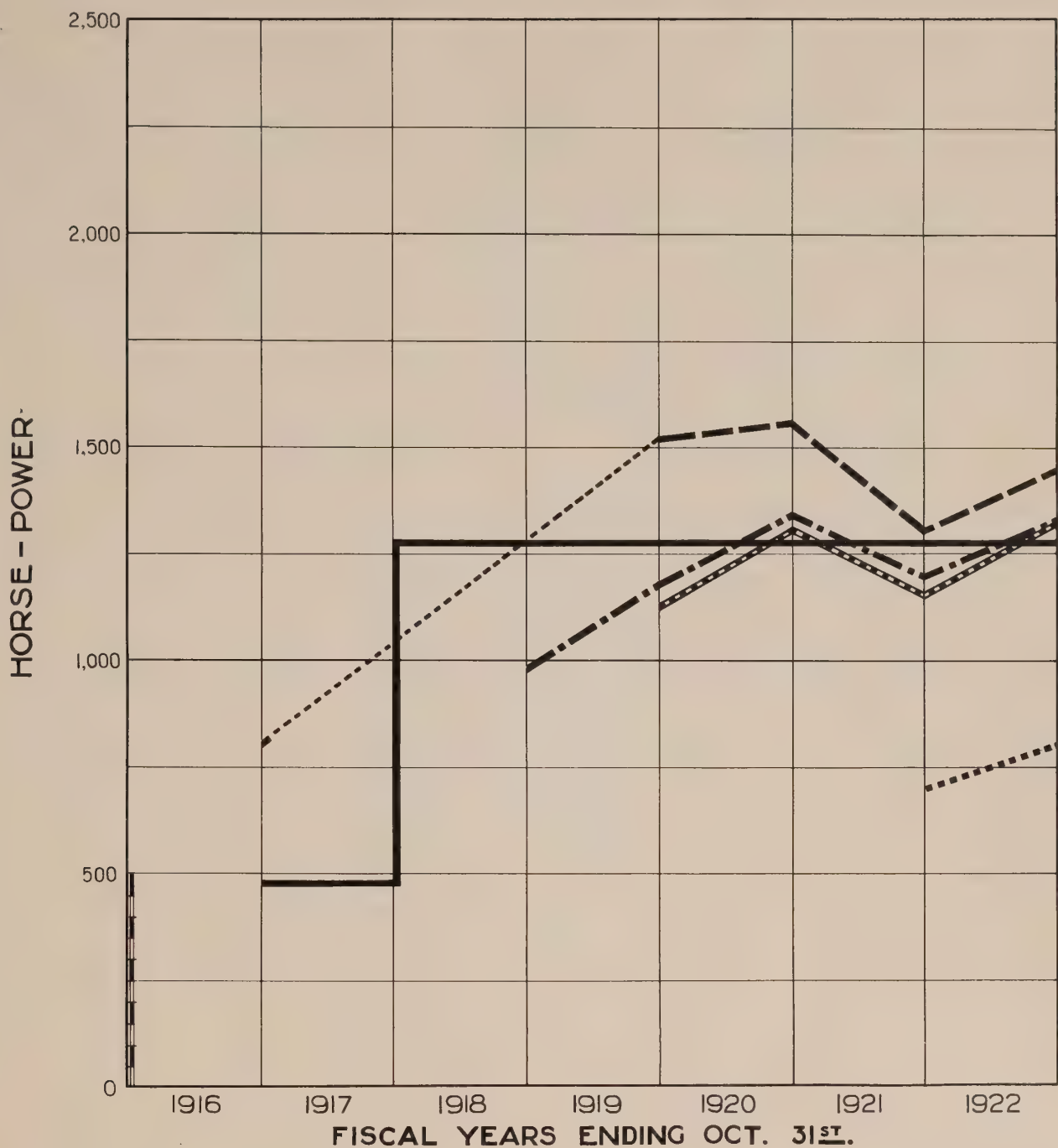
COPY

Hydroelectric Power

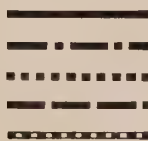
The following table shows the capacity of the hydroelectric plants in the City of Los Angeles. The capacity is given in kilowatts. The capacity of the plants is as follows:

Hydroelectric Power

The average hydroelectric capacity of the City of Los Angeles is 815 kilowatts. This is based on the capacity of the plants in operation. The capacity of the plants is as follows:



H.P. DEVELOPED
 H.P. BILLED
 H.P. CONSUMED
 MAXIMUM YEARLY PEAK
 AVERAGE OF 12 MONTHLY PEAKS



HYDRO-ELECTRIC INQUIRY COMMISSION
 W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

MUSKOKA SYSTEM

HORSE-POWER DATA

Toronto, April 14th., 1923. Made by *WJF* Checked by *LLH*

WALTER J. FRANCIS & COMPANY
 CONSULTING ENGINEERS

kilowatt-hours per annum by 8,760, being the number of hours in a year, and reducing to horse-power by dividing by the factor 0.746.

The diagram indicated on page 20 and the following table indicate the Billed Horse-power.

The curve for total horse-power billed, from 1918 to 1921 inclusive, was plotted from data given on page 9 of the report of Messrs. Price, Waterhouse & Co., already referred to, and is the amount charged to consumers on the System. The figure for horse-power billed in 1922 was computed from the records of the Hydro-Electric Power Commission of Ontario.

COPY

Average Monthly Peaks.

The curve of average monthly peaks was obtained by taking the average of the 12 monthly maximum peaks for each year as shown in the records of the Hydro-Electric Power Commission of Ontario, (dividing the sum of the monthly peaks by 12, to get a yearly average monthly peak). Each of these averages was then plotted as a single point for the average monthly peak of each year.

Maximum Yearly Peaks.

The curve showing the maximum yearly peaks was plotted directly from the maximum peak indicated for each year from the same source as used for the derivation of the curve of average monthly peaks.

210000-horse-power was shown by 0.746, being the number of hours in a year.

had yielded to horse-power by dividing by the factor 0.746.

Adjusted Horse-Power

The curve for total horse-power billed, from 1912 to 1921 inclusive, was plotted from data given in page 7 of the report of Western Union. The curve was plotted on the system. The figure for horse-power billed in 1921 was not taken from the reports of the Electric Light Power Commission in 1921.

COPY

Adjusted Horse-Power

The curve of average monthly power was obtained by taking the average of the 12 monthly maximum power for each year as shown in the report of the Electric Light Power Commission in 1921. (Attaching the report of the Electric Light Power Commission in 1921, to get a fairly accurate monthly power. The average was then plotted as a single point on the average monthly power

of each year.

Adjusted Horse-Power

The curve showing the maximum monthly power was plotted directly from the curve of maximum power. The curve of maximum power was plotted from the derivation of the curve of average monthly power.

\$500

Capital Costs per Horse-power Developed.

The diagram included as page 30 and the following table indicate the fractional capital costs per fiscal year per rated horse-power developed at different points of delivery, based on the figures showing the capital costs of the System, and the horse-power data given above. This sheet of curves, therefore, indicates the capital costs per rated plant horse-power with the spaces between adjacent curves indicating that portion of the total (delivered) capital cost per horse-power chargeable against each of the items of the table, as follows:

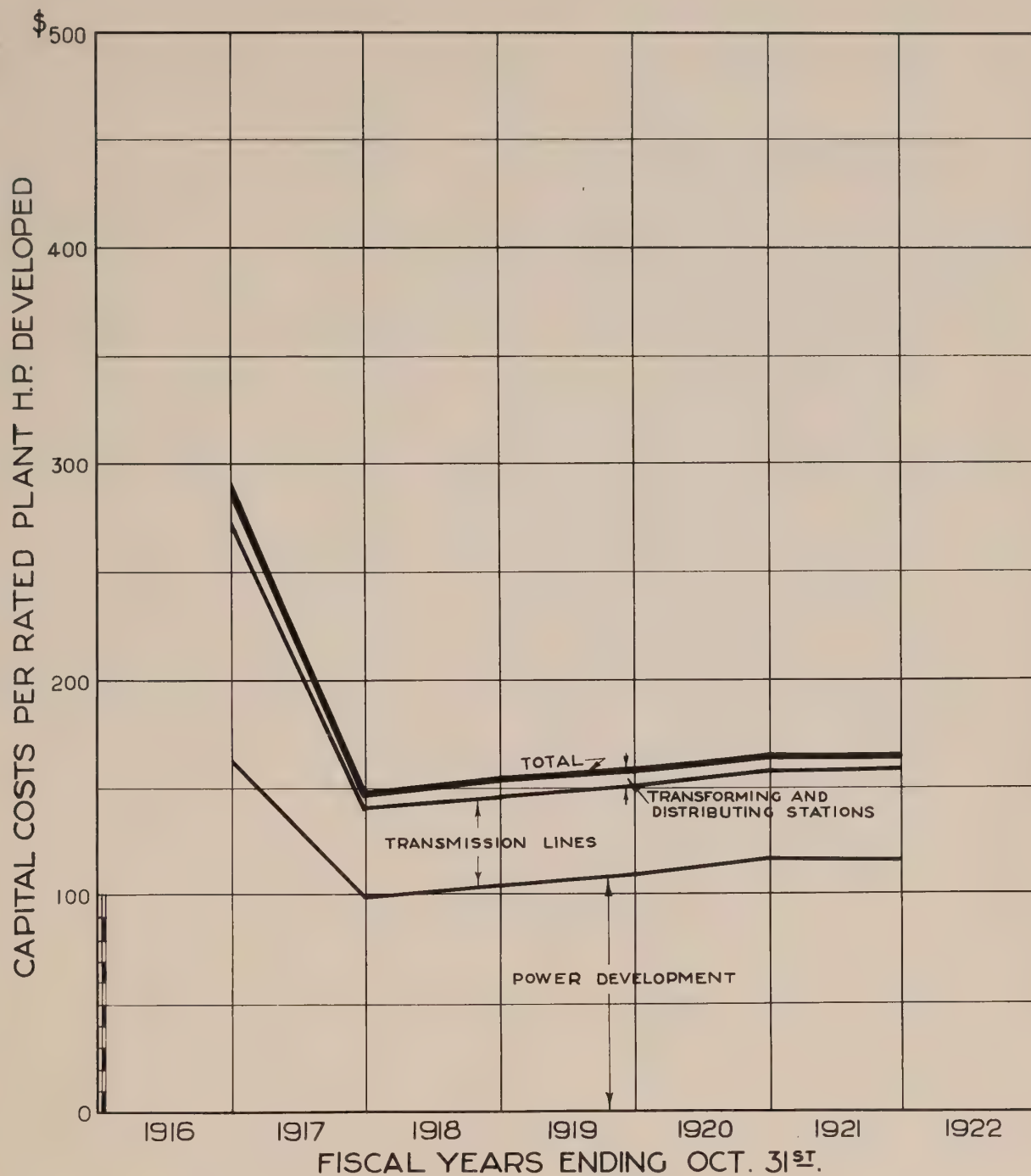
Table of Capital Costs per Rated Plant Horse-power Developed

	Fiscal Years Ending October 31st,					
	1916	1917	1918	1919	1920	1921
Power Development	\$164.10	\$99.50	\$105.00	\$108.80	\$115.80	\$116.00
Transmission Lines	109.50	42.40	42.40	42.40	42.40	42.40
Transforming and Distributing Stations	18.60	6.96	7.52	7.53	7.65	7.74
Totals	\$292.20	\$148.86	\$154.92	\$158.73	\$165.85	\$166.14

It will be seen from this table that the capital costs per rated plant horse-power developed are high for 1916. This is due to the fact that the repairs and additions to the South Falls plant were made during this year and the expenditures therefor were included, while no additional power had yet been made available.

Total Annual Revenues.

The following table, giving the total annual revenues of the Muskoka



HYDRO-ELECTRIC INQUIRY COMMISSION
 W. D. GREGORY, CHAIRMAN
 ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS
MUSKOKA SYSTEM
CAPITAL COSTS
PER HORSE-POWER DEVELOPED
 Toronto, April 4th., 1923. Made by *WJF*, Checked by *WJF*
 WALTER J. FRANCIS & COMPANY
 CONSULTING ENGINEERS

\$ 50,000

System has been prepared by using the figures of Exhibit I of the "Report on Investigation of Accounts of Muskoka System" dated November 7th, 1922, Hydro-Electric Inquiry Commission file No. 198-a-3, applying to the years 1918 to 1921 inclusive. The figure for the year 1917 was obtained from the Annual Report of the Hydro-Electric Power Commission. The sheet of curves on page 32 shows the revenues in graphic form. The table of total annual revenues is as follows:

Table of Total Annual Revenues

Revenue From	1917	1918	1919	1920	1921
Municipalities	\$19,815	\$23,739	\$27,064	\$27,184	\$27,122
Sundry Customers, (Muskoka Falls)	-	59	59	54	51
Totals	\$19,815	\$23,798	\$27,123	\$27,238	\$27,173

0,000

Total Annual Costs of Power.

The table on page 34 shows the costs of power subdivided under various headings for the years 1917 to 1921 inclusive. The figures for 1918 to 1921, inclusive, are made up from Exhibit I of the Price, Waterhouse & Co. report dated November 7th, 1922, while the figures for the year 1917 were obtained from the Annual Report of the Hydro-Electric Power Commission. From this information, and from the table of total revenues, it may be deduced that the municipalities were charged with the cost of power and the distribution thereof, as well as with that portion of the fixed charges pertaining to the power supply.

TOTAL ANNUAL REVENUES

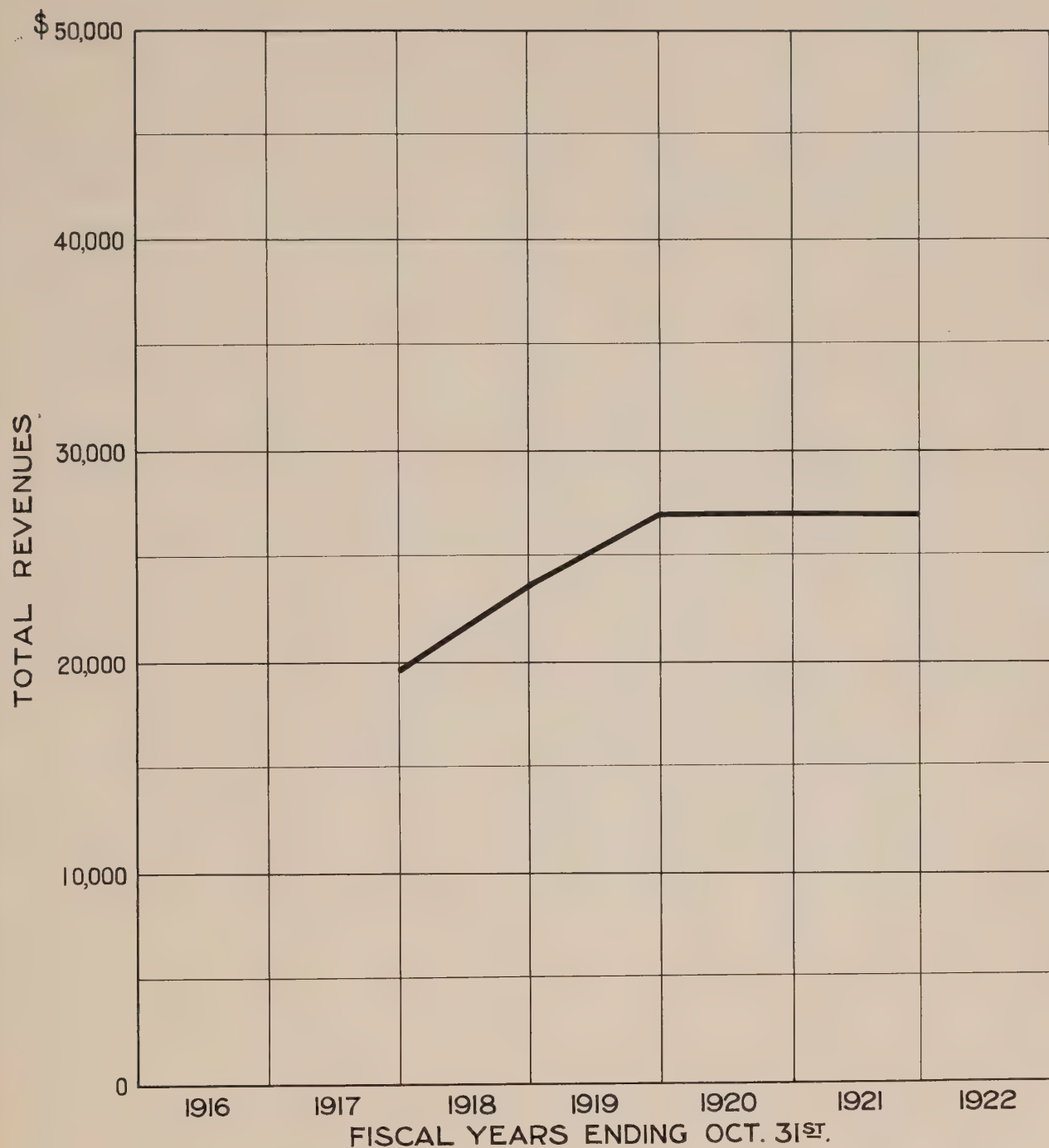
Report of the Hydrographic Survey Commission. The amount of money to pay 25
to that Institute. The money for the year 1917 was obtained from the annual
Hydrographic Survey Commission. The amount of money to pay 25
on investigation of accounts of Institute Hydrographic Survey Commission. The amount of money to pay 25
Hydrographic Survey Commission. The amount of money to pay 25

removed from the list of old

Account Title	1957	1958	1959	1960	1961
Investments	100,000	100,000	100,000	100,000	100,000
Fixed Assets	100,000	100,000	100,000	100,000	100,000
Current Assets	100,000	100,000	100,000	100,000	100,000
Liabilities	100,000	100,000	100,000	100,000	100,000
Equity	100,000	100,000	100,000	100,000	100,000

Total Annual Costs of Power.

the power supply.



HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN
ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS
MUSKOKA SYSTEM
TOTAL ANNUAL REVENUES
Toronto, April 14th., 1923. Made by *gfb*, Checked by *lde*
WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

Interest, Depreciation, etc.

The headings under which the various costs have been grouped are as follows:

Operating Costs.

Operating costs include the wages of power-house operators, linemen, station attendants, and so forth, supplies and all miscellaneous items usually grouped under this heading.

Maintenance.

COPY

Under maintenance have been placed all the items for labour and materials charged in the books of the Commission as against the individual portions of the plant, stations, lines and distributing station, and these have been grouped together from the individual figures in the Price, Waterhouse & Co., report, to make one item.

Overhead and General Expense.

Under the heading of overhead and general expense are such items as salaries of local officers and clerks, printing and stationery, stores operation, taxes, insurance, rents, legal expense, miscellaneous office supplies and so forth, all in accordance with the Price, Waterhouse & Co., report, supplemented for the year 1917 from the Annual Report of the Hydro-Electric Power Commission.

The following items were the subject of the report:

as follows:

Operative Cases

During the period covered by the report, the following cases were operative, and in some, the following cases were operative under this heading.

Maintenance

COPY

Under maintenance, the following cases were operative, and in some, the following cases were operative under this heading.

Financial and General

Under the heading of financial and general, the following cases were operative, and in some, the following cases were operative under this heading.

\$50,000

Interest, Renewals, Sinking Fund and Contingencies

The figures for interest include all interest charges shown for the capital invested in the System.

The renewal account includes all items shown as chargeable against renewals in the same report, while the figures for sinking fund and for contingencies have been transferred directly from the report.

The sheet of curves on page 35 is the direct plotting of the figures in the table below with the spaces between adjacent curves indicating the amount chargeable against that particular item. The figures are as follows:

Table of Total Annual Costs of Power

	Fiscal Year Ending October 31st,				
	1917	1918	1919	1920	1921
Operation		\$4,312	\$5,105	\$5,374	\$5,522
Maintenance	\$8,383	2,160	3,061	1,696	2,752
Overhead & General Expense		2,170	2,712	2,705	2,832
Interest	8,369	7,931	8,802	9,662	9,670
Renewals	3,063	6,940	7,110	7,432	5,313
Sinking Fund	-	-	-	-	751
Contingencies	-	247	296	338	302
Totals	\$19,815	\$23,760	\$27,086	\$27,207	\$27,142

The total revenue for 1916 is given as \$11,770 and the total costs of power for that year as \$11,063.47, showing a profit on the sale of power of \$707.00. These figures were not included in the tables and diagrams, there being no available record of the subdivision of costs under the various headings for the year 1916.

It will be noted that there is a small difference between the total

TOTAL ANNUAL COSTS

Consolidated Statement of Profit and Loss

The figures for interest include all interest charges shown for the capital invested in the system.

The various amounts included in the statement are as follows: The various amounts included in the statement are as follows:

contingencies have been provided for in the statement.

The amount of reserve for depreciation is the amount of the reserve for depreciation.

for the period ended 31st March 1955.

amount included in the statement for the period ended 31st March 1955.

COPY

Financial Year Ending October 31st					
1954	1953	1952	1951	1950	1949
Operating	10,000	10,000	10,000	10,000	10,000
Interest	10,000	10,000	10,000	10,000	10,000
Depreciation & Amortization	10,000	10,000	10,000	10,000	10,000
Interest	10,000	10,000	10,000	10,000	10,000
Reserve	10,000	10,000	10,000	10,000	10,000
Sinking Fund	10,000	10,000	10,000	10,000	10,000
Contingencies	10,000	10,000	10,000	10,000	10,000
Total	10,000	10,000	10,000	10,000	10,000

The total revenue for 1954 is shown as \$11,775 and the total expense as

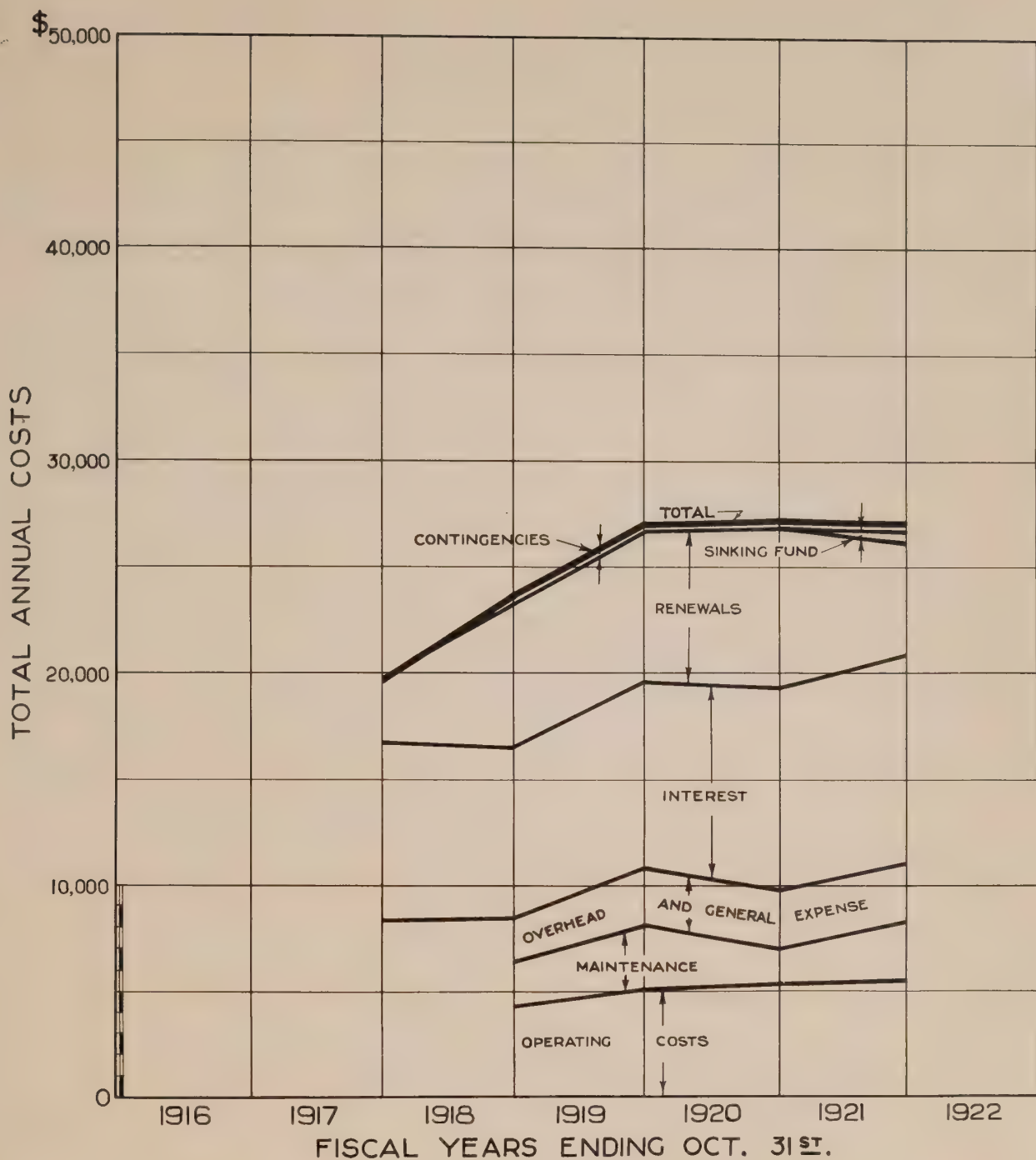
\$11,775, leaving a profit of \$11,775.

These figures are not included in the consolidated statement.

being available for the purpose of the statement.

headings for the year 1955.

It will be noted that there is a small difference between the total



HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

MUSKOKA SYSTEM

TOTAL ANNUAL COSTS

Toronto, April 14th., 1923. Made by *WJF*, Checked by *WJF*

WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

revenues and the total costs of power for each of the years 1918, 1919, 1920 and 1921, amounting to \$38.00, \$37.00, \$31.00 and \$31.00 respectively. These represent the profits on power sold to sundry customers at Muskoka Falls, and it is stated that these amounts have been transferred to the reserve for contingencies, thus making the total revenues and the total costs of power balance in each year.

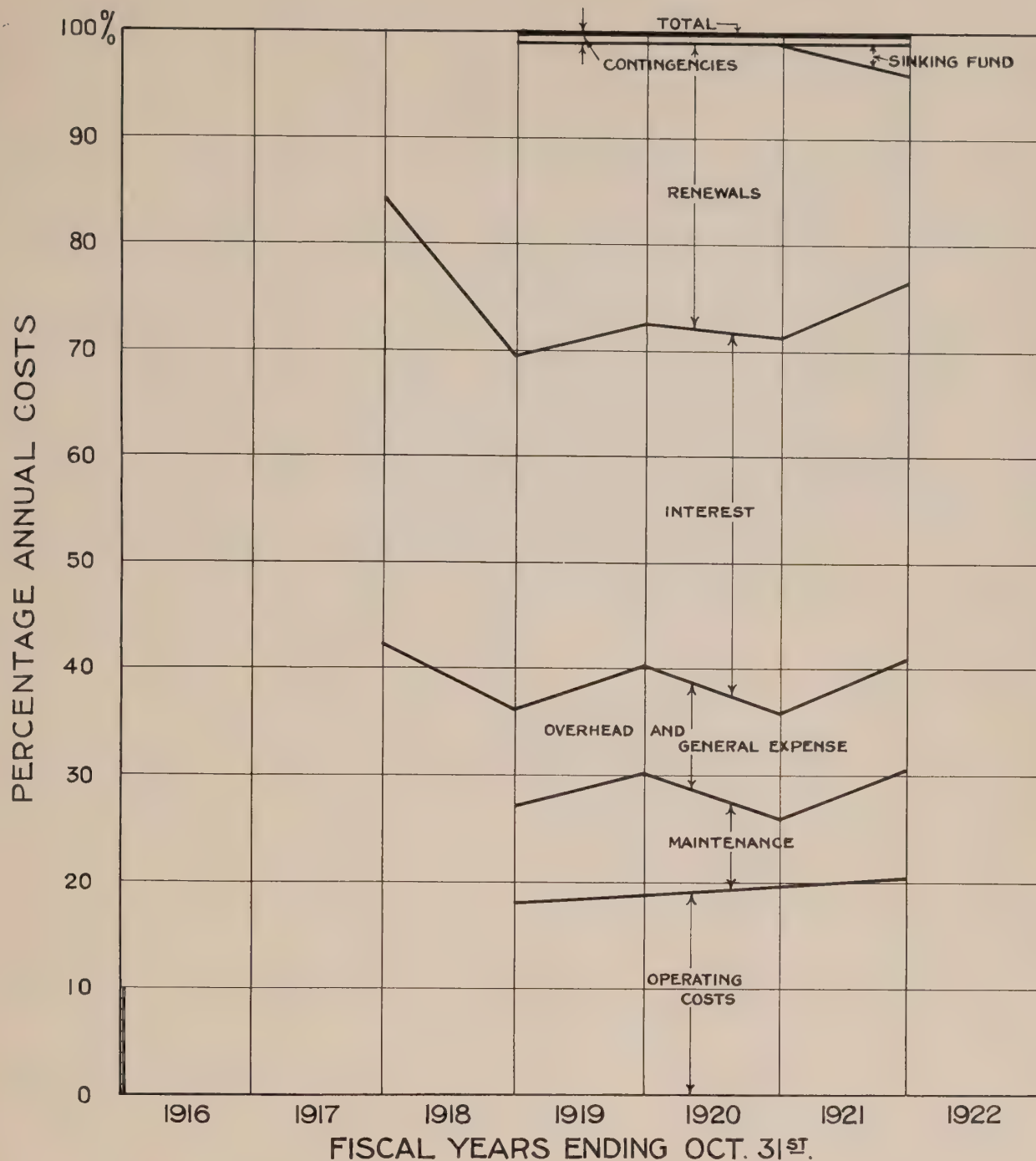
Percentage Costs of Power.

The following table and the sheet of curves included as page 37 show the cost figures as percentages of the total cost of power per annum, and these are included as a method of comparison with other systems or similar properties:

Table of Annual Costs Subdivided by Percentages

	Fiscal Years Ending October 31st,				
	1917	1918	1919	1920	1921
	%	%	%	%	%
Operation	(18.14	18.86	19.77	20.38
Maintenance	(42.30	9.10	11.30	6.23	10.13
Overhead & General Expense	(9.14	10.01	9.95	10.42
Interest	42.25	33.38	32.51	35.51	35.63
Renewals	15.45	29.20	26.23	27.30	19.56
Sinking Fund	-	-	-	-	2.77
Contingencies	-	1.04	1.09	1.24	1.11
Totals	100%	100%	100%	100%	100%

HYDRO-ELECTRIC POWER TRANSMISSION
 & DISTRIBUTION
 COMPANY OF R.E.P. ENGINEERS & ARCHT.
 MUSKOKA SYSTEM
 ANNUAL COSTS SUBDIVIDED
 BY PERCENTAGES
 PREPARED BY WALTER J. FRANCIS & COMPANY
 1921



HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

MUSKOKA SYSTEM

ANNUAL COSTS SUBDIVIDED
BY PERCENTAGES

Toronto, APRIL 14th 1923. Made by *WJF*, Checked by *WJF*

WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

\$ 250,000

Analysis of Reserve Accounts.Renewals Account.

The following table, and the sheet of curves included as page 39, show the amounts set aside as reserve for renewals as they exist at the present time on the books of the Hydro-Electric Power Commission. As stated on page 10 in the report of Messrs. Price, Waterhouse & Co., the balance in the reserve for renewals of the Muskoka System amounted to \$25,471.30, at October 31st, 1921, after giving effect to the adjustment discussed below, and may be briefly summarized as follows:

COPY

Table of Reserve for Renewals

Fiscal Year	Reserve on 2.5% Basis		
	Net	Interest	Total
1917	\$4,184	-	\$4,184
1918	4,957	\$167.00	5,124
1919	5,078	373.00	5,451
1920	5,309	590.00	5,899
1921	5,313	823.00	6,136
Together	\$24,841	\$1,953.00	\$26,794
Deductions for replacements and sundry charges	1,180	143.00	1,323
Totals at Oct. 31, 1921	\$23,661	\$1,810.00	\$25,471

During the period from the fiscal year 1917, which was the first year of operation of the renewals account, to October 31st, 1920, the additions to the reserve for renewals in respect to the properties of the System, were

RESERVES FOR RENEWALS

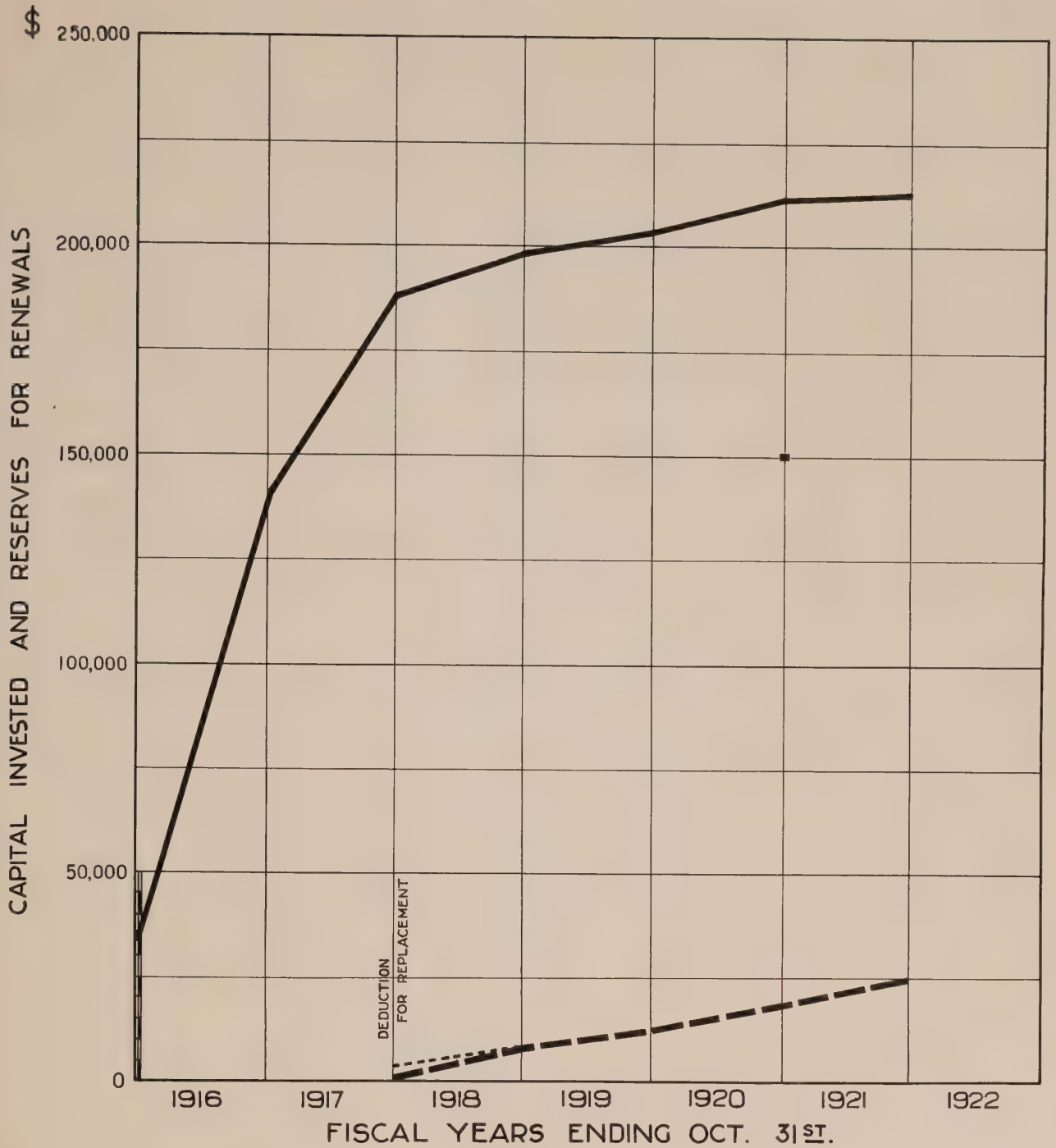
The following table, and the sheet of notes included on page 20, show the amounts set aside as reserve for renewals as they exist at the present time on the books of the Western-Union Telegraph Company, as shown in the report of Messrs. Price, Waterhouse & Co., the balance in the reserve for renewals of the Western-Union Telegraph Company at the present time, 1901, after giving effect to the proposed extension of the

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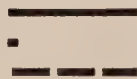
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During the period from the fiscal year 1917, which was the first year of operation of the renewal account, to October 31st, 1920, the additions to the account had resulted in a total of \$1,000,000.00.



TOTAL CAPITAL INVESTED
 TOTAL DEPRECIABLE CAPITAL
 RESERVE FOR RENEWALS



HYDRO-ELECTRIC INQUIRY COMMISSION
 W. D. GREGORY, CHAIRMAN
 ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS
MUSKOKA SYSTEM
RESERVES FOR RENEWALS

Toronto, April 14th., 1923. Made by *WJF* Checked by *WJF*

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provided through inclusion in the cost of power to the municipalities, of an annual charge of 3.5 per cent. on the capital investment, together with interest at the rate of 4 per cent. per annum on the balance on the reserve account. This followed the usual method, known as the sinking fund basis, for providing a fund for renewals for plant deteriorating in use. The useful life in years of each portion of the depreciable capital invested, the replacement cost, and the residual or scrap value of the articles at the end of this time are all estimated, and an amount is set aside which, when compounded at an assumed earning rate, will retire the total amount to be provided for at the end of its own particular useful life.

COPY

On the recommendation of its engineers, the Commission, commencing in the fiscal year 1921, reduced the annual renewal rate from 3.5 per cent. to 2.5 per cent. on the total capital investment, while the interest rate of 4 per cent. remained unchanged. The accounts of the Commission were so adjusted that the rate of 2.5 per cent. was made effective from 1917 to October 31st, 1920, and the same renewal rate has obtained to October 31st, 1921.

The annual rate of 2.5 per cent., we are advised, is based upon a re-classification of the various properties in connection with the Muskoka System as shown in the book accounts as at October 31st, 1920, from which the engineers of the Hydro-Electric Power Commission deducted certain properties of a substantial nature which they considered should have no provision for renewals, for example, reinforced concrete dams, floodage, water

total amount to be provided for at the end of its own particular useful life. outside which, when commenced at an assumed earning rate, will restore the articles at the end of their lives and all estimated, and an amount is not invested, the replacement cost, and the residual or scrap value of the use. The useful life in years of each portion of the depreciable capital

On the recommendation of its engineers, the Commission, commencing in the fiscal year 1931, reduced the annual renewal rate from 3.5 per cent. to 3.0 per cent. on the total capital investment, while the interest rate of 4 per cent. remained unchanged. The accounts of the Commission were so adjusted that the rate of 3.0 per cent. was made effective from 1917 to October 31st, 1930, and the same renewal rate was continued to October 31st, 1931.

[illegible]

rights and so forth. The actual rate arrived at was 2.424 per cent., but a rate of 2.5 per cent. was adopted as a matter of convenience. It is stated in the report of Messrs. Price, Waterhouse & Co., that clerical errors occurred in the computation of the engineering department, and the rate should have been 1.694 per cent. instead of 2.424 per cent., a difference of .73 per cent. As a result of this arithmetical discrepancy it is understood that the Commission is now considering a further reduction in the annual renewal rate and a consequent adjustment of the entire Reserve for Renewals Account.

The sinking fund basis of making additions to the reserve account for renewals at the rate of 2.5 per cent., together with interest at 4 per cent. per annum, is equivalent to the so-called straight line provision of approximately 4 per cent. for a period of 25 years. While the annual provisions under the two methods differ in amount, either method would accumulate the sum required in approximately that period.

It is understood that it is the practice of the Hydro-Electric Power Commission to spend sufficient money on maintenance account each year so as to keep each and every portion of the System in a condition to operate in accordance with the requirements of economical production, which it is stated is considered to be about 75 per cent. as good as its original new condition. This being so, it was considered in this report that the renewal account should be studied in connection with and applied to the renewal of only 25 per cent. of the capital concerned.

Two questions should receive consideration in dealing with the

in the annual renewal rate and a corresponding adjustment of the entire

reserve for renewals, one is the proposed change in the estimated useful length of life of the various portions of equipment which will materially affect the annual allowances, and the other is the proper rate of interest to be chosen in estimating the earning power of the invested reserve funds.

A strict theory of the earning power of the renewal fund would take into consideration not only the method of investing the fund, for example, whether it be used in making extensions and betterments in the System as has actually been done, or invested in separate securities and treated like a trust fund, but also the rate of annual interest which should be adjusted each year in accordance with the actual value of the money.

At the present time the total depreciable capital is probably about \$151,000, while the reserve for renewals to the end of 1921 was about \$25,471, and should be about \$31,500 at the end of 1922, assuming that the 2.5 per cent. rate was applied. As a large portion of the total depreciable capital has been invested within the past few years, and as the useful life of each portion of the equipment is really in the early stages, it would therefore appear that the present total accumulations of the fund as applicable to 25 per cent. of the total depreciable capital, is somewhat larger than is necessary, taking all the above factors into consideration.

Sinking Fund.

The study of the finances of the System shows that the amount computed

[illegible]

1900

Indicate the number of days you were away from work due to this injury.

as sinking fund for the sixth year of service to each of the municipalities on the System will, when multiplied at the same rate, be sufficient to provide for the financial obligations concerning the properties. The amount to the credit of this fund at October 31st, 1921, is stated to be \$750.60 in the Price, Waterhouse & Co. report, and is the amount included in the cost of power for the year ending October 31st, 1921, charged against the Municipality of Gravenhurst. This was based on 1.8 per cent. of \$41,700, the capital investment as at October 31st, 1921, chargeable against the Municipality of Gravenhurst. No sinking fund charge has been included in the cost of power for the Municipality of Huntsville at October 31st, 1921, as it had been supplied for about five years only, but the charge for the first sinking fund year should be included in the cost of power for the fiscal year 1922. This was computed to be \$3,070, being 1.8 per cent. of \$170,547, the total capital investment at October 31st, 1921, chargeable against the Municipality of Huntsville. A sinking fund payment of \$5.12 was also computed at 1.8 per cent. of the total capital investment of \$284.00 chargeable against the sundry customers at Muskoka Falls. The payment of this item has been deferred until the year ending October 31st, 1922. The aggregate of the sinking fund charges shown above, together with that chargeable to Gravenhurst for 1922, shows a probable total of \$4,576 at October 31st, 1922.

Reserve for Contingencies.

A study of the accounts of the System shows that up to the end of 1921

[illegible]

a total reserve for contingencies had been set aside amounting to \$1,911, made up of an annual charge of 25 cents per horse-power on the average power billed to the municipalities, and of certain profits realized on sales to sundry customers, together with the profit from the rental and sales of miscellaneous equipment, and an allowance for interest at 4 per cent. per annum.

No deductions have been made from this fund, due probably to the short time the greater part of the equipment has been in service.

Considering the heavy losses which might be occasioned through catastrophe, or other contingencies, it is considered that the total amount at the credit of this fund, namely, \$1,911, should be augmented by increasing the annual allowance for contingencies, and when a reserve of say \$5,000 to \$10,000 will have been built up, the rates can be readjusted to suit the conditions found after several further years of experience.

Discussion of Deficits and Surpluses.

The records show that the System as a whole has been billed with the cost of power in accordance with the book-keeping methods of the Hydro-Electric Power Commission since 1918, and that there are now no deficits or surpluses for the System as a whole. This does not take into account the local distribution in the various municipalities which is done by the municipality itself, and where the profits or losses are not included in the accounts of the Hydro-Electric Power Commission for the Muskoka System.

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time the greater part of the regiment has been in service.

Considering the heavy losses which might be occasioned through extra-

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most of power in accordance with the book-keeping methods of the Hydro-
Electric Power Commission, and the same book-keeping methods
are employed for the purpose of the same. The same book-keeping methods
the local distribution in the various municipalities which is done by the
municipality itself, and where the profits or losses are not included in

Revenues and Costs per Horse-power per Annum.

Included as pages 47, 48 and 49, show the details of the cost per annum

Annual Revenues per Horse-power.

were plotted are the figures for the operating costs given in the table on page 34 divided by the number for the various classes of horse-power already given in the text. The sheet of curves included on page 47 is similar to the usual practice of similar companies and of distribution authorities. Total costs per horse-power per annum for the different classifications in the table below has been prepared to show the revenues per horse-power per annum for different bases of horse-power. It will be noted that the total costs per annum for different bases of horse-power in the fiscal years 1918, 1919, 1920 and 1921 are not balanced.

Table of Revenues per Horse-power per Annum

Revenues per Horse-power	Fiscal Year Ending October 31st,				
	1917	1918	1919	1920	1921
Developed	\$15.49	\$18.60	\$21.20	\$21.32	\$21.21
Consumed	-	-	-	-	38.57
Billed	-	24.25	22.86	20.20	22.53
Average of 12 Monthly Peaks	-	-	23.92	20.73	23.18
Maximum Yearly Peak	-	-	17.80	17.38	20.65

Annual Costs per Horse-power.

In a similar way the total costs have been reduced to costs per horse-power per annum for different bases of horse-power, and have also been analyzed to show the total annual costs subdivided into fractional amounts chargeable against each kind of expense based on the horse-power rating of the plant, and also on the average horse-power billed.

ANNUAL REPORT OF THE BOARD OF DIRECTORS

FINANCIAL STATEMENTS

In order to reduce the total revenues and total costs of operation to a basis where there would be comparability with other systems, and to agree with the usual practice of other companies, the following table has been prepared to show the revenue per horse-power per annum for different bases of horse-power.

Table showing the revenue per horse-power per annum

Revenue per horse-power	Basis of horse-power				Average of 12 months	Average of 12 months
	1915	1916	1917	1918	1919	1920
Developed	11.50	12.50	13.50	14.50	15.50	16.50
Installed	11.50	12.50	13.50	14.50	15.50	16.50
Rated	11.50	12.50	13.50	14.50	15.50	16.50
Actual at 12 months	11.50	12.50	13.50	14.50	15.50	16.50
Actual 12 months	11.50	12.50	13.50	14.50	15.50	16.50

GENERAL STATEMENT OF FINANCIAL RESULTS

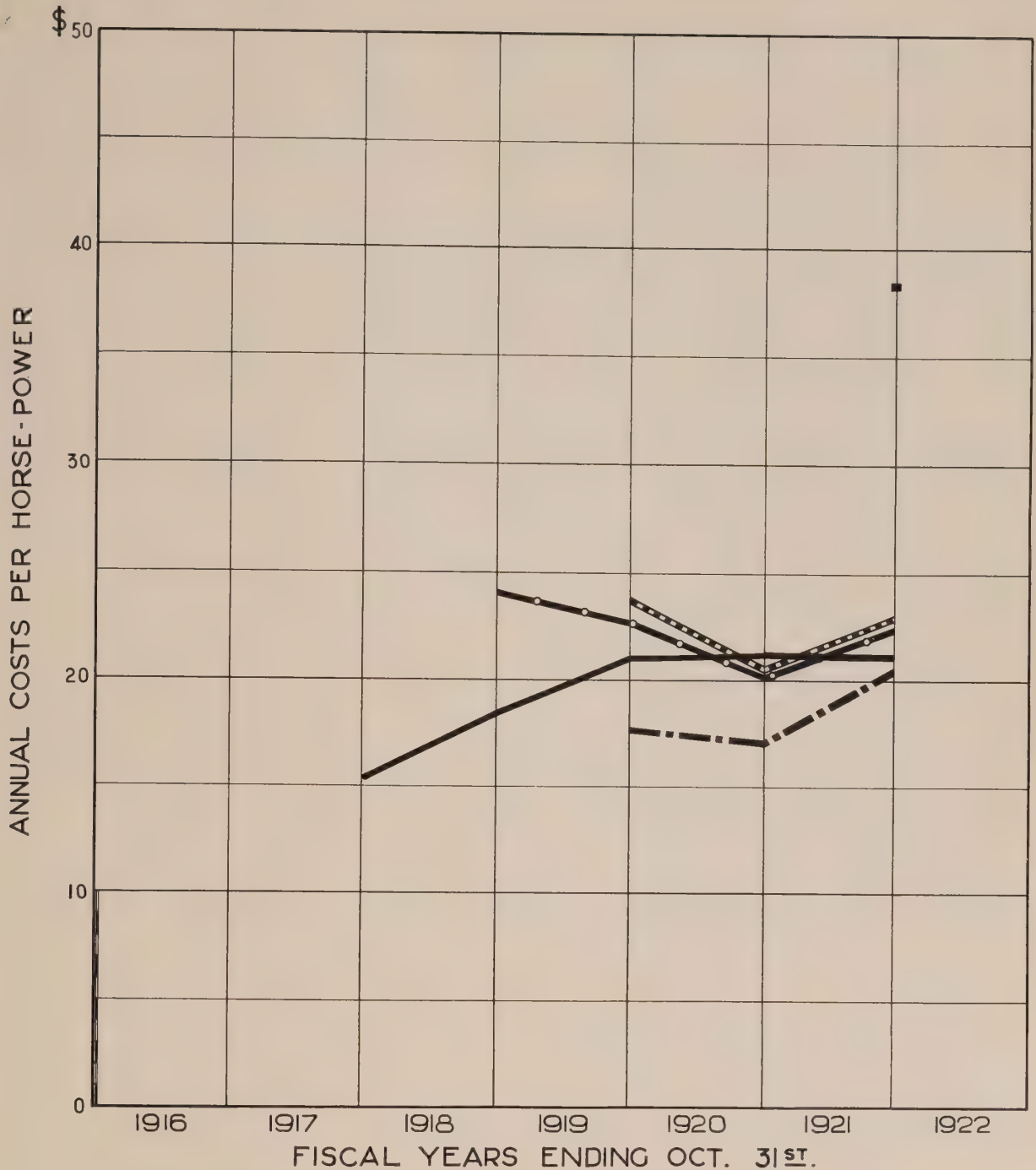
The statement of the Board of Directors shows the financial results of the company for the year 1920. The statement is divided into two parts, the first part showing the financial results of the company for the year 1920, and the second part showing the financial results of the company for the year 1921. The statement is divided into two parts, the first part showing the financial results of the company for the year 1920, and the second part showing the financial results of the company for the year 1921. The statement is divided into two parts, the first part showing the financial results of the company for the year 1920, and the second part showing the financial results of the company for the year 1921.

The tables shown below and on page 50, and the three sheets of curves included as pages 47, 48 and 49, show the details of the cost per horse-power per annum on different bases. The figures from which these curves were plotted are the figures for the operating costs given in the table on page 34 divided by the figures for the various classes of horse-power already given in the text. The sheet of curves included as page 47 indicates the total costs per horse-power per annum for the different classifications of horse-power already discussed. It will be noted that the total costs per horse-power in the fiscal years 1918, 1919, 1920 and 1921 do not balance with the total revenues per horse-power on account of the fact that there were small profits during these years on the sale of power to the sundry customers at Muskoka Falls, but these were later transferred to the reserve for contingencies.

Table of Total Costs per Horse-power per Annum

	Fiscal Year Ending October 31st.				
	1917	1918	1919	1920	1921
H.P. Developed	\$15.49	\$16.57	\$21.17	\$21.26	\$21.22
H.P. Consumed	-	-	-	-	38.52
H.P. Billed	-	24.22	22.84	20.16	22.50
H.P. Average 12 Monthly Peaks	-	-	23.90	20.67	23.10
H.P. Maximum Yearly Peak	-	-	17.78	17.34	20.62

Hydro-Electricity Development Corporation
 100 Queen's Quay West
 Toronto, Ont.
 DIVISION OF H.E.P.C. Engineering Section
MUSKOKA SYSTEM
TOTAL COST PER H.P. PER ANNUM
VARIOUS H.P. BASES
 Report April 25th 1922. Made by H.E.P.C. Engineers
 Walter J. Francis & Company
 Consulting Engineers



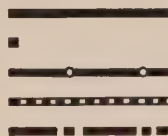
H. P. DEVELOPED

H. P. CONSUMED

H. P. BILLED

AVERAGE OF 12 MONTHLY GENERATED PEAKS

MAXIMUM YEARLY PEAK

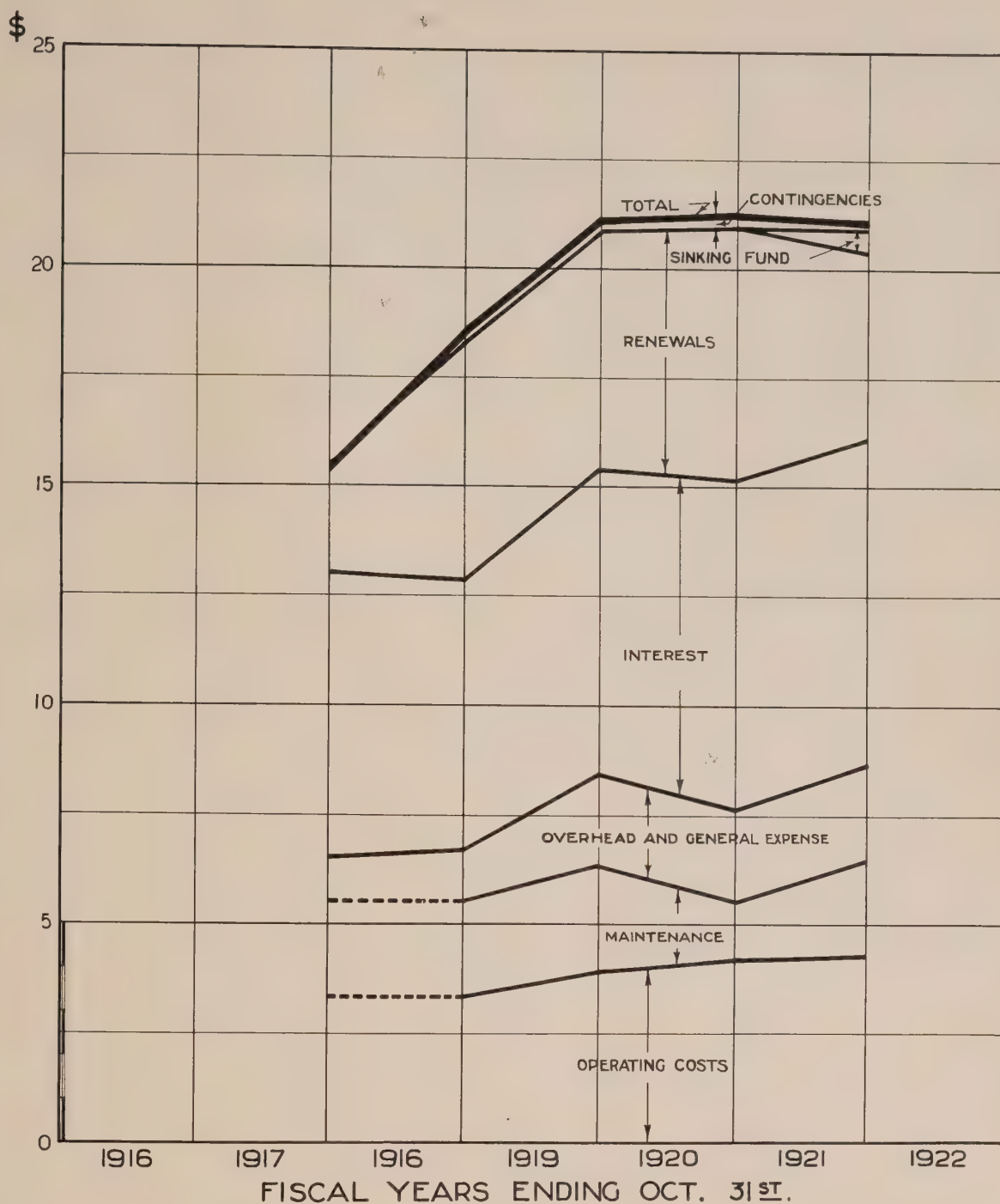
HYDRO-ELECTRIC INQUIRY COMMISSION
W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

MUSKOKA SYSTEM

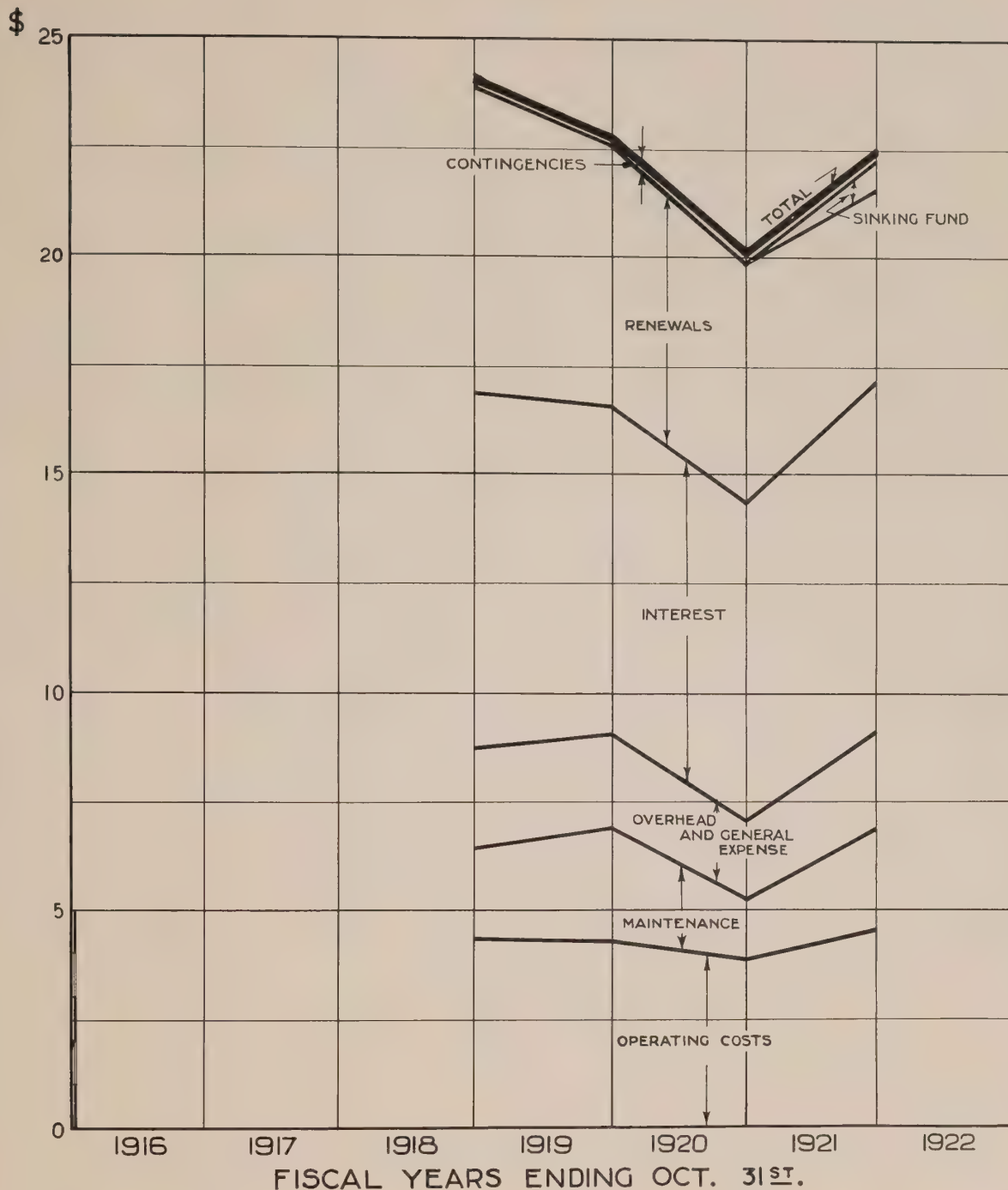
**TOTAL COSTS PER H.P. PER ANNUM
VARIOUS H.P. BASES**Toronto, April 14th., 1923. Made by *WJF*, Checked by *WJF*WALTER J. FRANCIS & COMPANY
CONSULTING ENGINEERS

ANNUAL COSTS PER H.P. DEVELOPED



HYDRO-ELECTRIC INQUIRY COMMISSION
 W. D. GREGORY, CHAIRMAN
 ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS
MUSKOKA SYSTEM
SUBDIVIDED COSTS PER ANNUM
PER H. P. DEVELOPED
 Toronto April 14th., 1923. Made by *WJF* Checked by *WJF*
 WALTER J. FRANCIS & COMPANY
 CONSULTING ENGINEERS

ANNUAL COSTS PER H.P. BILLED



HYDRO-ELECTRIC INQUIRY COMMISSION
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MUSKOKA SYSTEM
SUBDIVIDED COSTS PER ANNUM
PER H. P. BILLED
 Toronto, April 14th., 1923. Made by *W. J. F.* Checked by *L. H.*
 WALTER J. FRANCIS & COMPANY
 CONSULTING ENGINEERS

Table of Subdivided Costs per Horse-power Developed

	Fiscal Year Ending October 31st.				
	1917	1918	1919	1920	1921
Operating	(\$3.37	\$3.99	\$4.20	\$4.32
Maintenance	\$6.55	1.69	2.39	1.32	2.15
Overhead & General Expense	(1.70	2.12	2.11	2.21
Interest	6.54	6.20	6.88	7.56	7.56
Renewals	2.40	5.42	5.56	5.81	4.15
Sinking Fund	-	-	-	-	0.59
Contingencies	-	.19	.23	.26	.24
Totals	\$15.49	\$18.57	\$21.17	\$21.26	\$21.22

Table of Subdivided Costs per Horse-power Billed

	Fiscal Year Ending October 31st.				
	1917	1918	1919	1920	1921
Operating		\$4.40	\$4.30	\$3.98	\$4.58
Maintenance		2.20	2.56	1.26	2.28
Overhead & General Expense		2.21	2.29	2.00	2.35
Interest		8.08	7.42	7.16	6.02
Renewals		7.08	6.00	5.51	4.40
Sinking Fund		-	-	-	.62
Contingencies		.25	.25	.25	.25
Totals		\$24.22	\$22.84	\$20.16	\$22.50

Kilowatt-hour Data and Annual Revenues and Costs per Kilowatt-hour.

The engineers of the Hydro-Electric Power Commission state that prior to 1921 there is no reliable record of the number of kilowatt-hours supplied

Table of Subdivided Costs per Horse-power Developed

	1917	1918	1919	1920	1921
Operating	(\$8.27	\$5.22	\$4.20	\$6.22
Maintenance	(1.23	2.22	1.22	2.12
Interest	(1.22	2.22	2.12	2.12
Depreciation	6.84	6.20	6.88	7.22	7.22
Renewals	2.40	2.42	2.22	2.22	2.12
Sinking Fund	-	-	-	-	0.22
Contingencies	-	1.12	2.22	2.22	2.22
Totals	\$12.42	\$12.22	\$12.12	\$12.22	\$12.22

Table of Subdivided Costs per Horse-power Developed

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	1917	1918	1919	1920	1921
Operating	\$11.22	\$11.22	\$11.22	\$11.22	\$11.22
Maintenance	2.22	2.22	2.22	2.22	2.22
Interest	2.22	2.22	2.22	2.22	2.22
Depreciation	7.22	7.22	7.22	7.22	7.22
Renewals	2.40	2.40	2.40	2.40	2.40
Sinking Fund	-	-	-	-	-
Contingencies	2.22	2.22	2.22	2.22	2.22
Totals	\$25.22	\$25.22	\$25.22	\$25.22	\$25.22

Table of Subdivided Costs per Horse-power Developed

The following table shows the results of the investigation of the various factors which enter into the cost of electricity, and the results of the various experiments conducted for the purpose of determining the most economical method of generating electricity.

to the Muskoka System. It is estimated by them that the total kilowatt-hours consumed in 1921 for the Muskoka System amounted to 4,605,325. This being the only figure available up to that date, it is impracticable to plot diagrams for kilowatt-hour consumption or costs, and the only thing possible is to show an analysis or subdivision of the total costs based on the average horse-power consumed and the kilowatt-hours for 1921. For 1922 the kilowatt-hours are about 5,300,881. The figures are as follows:

Domestic Consumer Municipal Light Consumer

Table of Subdivided Costs per Average Horse-power and
per Kilowatt-hour Consumed in 1921

	Dollars per H.P.	Cents per K.W.H.
Operating	\$7.84	0.120
Maintenance	5.91	0.060
Overhead & General Expense	4.02	0.062
Interest	13.73	0.210
Renewals	7.55	0.115
Sinking Fund	1.07	0.016
Contingencies	.43	0.006
Totals	\$38.55	0.569

Since the accounts show a small profit on the sale of power to sundry customers, the revenue per average horse-power consumed and the revenue per kilowatt-hour for 1921 are very slightly higher than the total costs.

The revenue per average horse-power consumed in 1921 was \$38.57, and the revenue per kilowatt-hour was 0.59¢. The following tables show the kilowatt-hours per consumer supplied for different purposes in the two municipalities of the Muskoka System for the year 1921, and also show the

Table of Subdivided Costs per Average Horse-power and
per Kilowatt-hour Consumed in 1921

GOVERNMENT OF INDIA

Account	Amount	Balance
100.00	100.00	
200.00	200.00	
300.00	300.00	
400.00	400.00	
500.00	500.00	
600.00	600.00	
700.00	700.00	
800.00	800.00	
900.00	900.00	
1000.00	1000.00	
Total	1000.00	1000.00

[illegible]

kilowatt-hours consumed for various classes of service averaged for the whole of the Muskoka System from 1917 to 1921 inclusive. The figures indicate the difficulty of comparing one place with another, as will be seen by the wide variation in the details given for the various places.

Table of Power Consumption by Municipalities

	Calendar Year 1921		
	K.W.H. per Domestic Consumer	K.W.H. per Commercial Light Consumer	Horse-power per Power Consumer
Gravenhurst	238	2,862	17.7
Huntsville			126.1

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Table of Kilowatt-hour Consumption - Various Classes

	Calendar Years				
	1917	1918	1919	1920	1921
K.W.H. per Domestic Light Consumer and, however, * 156	156	147	274	x 424	* 238
K.W.H. per Commercial Light Consumer * 2,490	2,490	1,213	1,775	x 623	* 2,856
x Excluding Gravenhurst.					
* Excluding Huntsville.					

Summary.

A summary of a number of the more salient points which have been studied and discussed in the foregoing report may be of advantage in continuing the consideration of the economics of the Muskoka System. They are as follows:

- (1) The capital costs of the Muskoka System contain an item of about \$17,400, representing the value of intangibles taken over with the South Falls plant. The capital costs of the South Falls generating station show reasonable construction costs and now stand at about \$116.00 per horse-power.
- (2) Capital costs for 1922 and 1923 amounting to \$10,000 will, if carried out as contemplated, make the total investment in the Muskoka System approximately \$221,500 at October 1923. This does not include, however, the cost of the equipment necessary to increase the capacity of the generating station, which, apparently, must be done in the near future.
- (3) The market for power has been well covered in the two municipalities served in the district. The density indicates a high percentage of consumers per capita of population. The demand for electricity is apparently still growing and indications are that further sources of power supply must be provided in the immediate future. The ultimate demand for power and the ultimate sources of supply should be considered in the near future.
- (4) The reserve for renewals should be carefully considered in its relation to the recently revised estimated useful life for various portions of the property, and also adjusted to allow for the actual cost of money year by year.
- (5) The reserve for contingencies has not yet been called upon to replace any losses due to catastrophe or other damage to properties. The fund, however, is very small and might with advantage be increased and yearly results noted so as to eventually devise a proper yearly allowance for the fund.
- (6) The operating records indicate that the System is being operated so as to supply power at cost, there being practically no difference between total revenues and total costs as shown on the Commission's books.
- (7) The question of sinking fund should be studied in its relation to the agreement between the Municipality of Huntsville and the Commission. The Huntsville agreement states that the municipality shall pay the necessary sinking fund installments for a period of sixteen years, while the Power Commission Act states that the sinking fund shall be on a basis of 30 years. Excerpts of these agreements are contained in pages 4 and 5 of the Price, Waterhouse & Co., report.
- (8) Complete kilowatt-hour records would be very desirable for all principal consuming points on the System, where these are not already kept.

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Walter J. Francis

Consulting Engineer.

Toronto, April 14th, 1923.

